Engin.

CHEMICAL & METALLURGICAL ENGINEERING

McGraw-Hill Co. Inc. | February 16, 1925 | 25 cents per copy

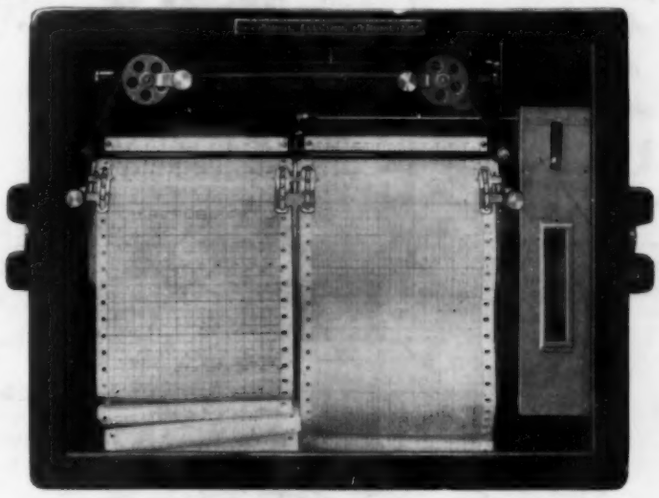
REPUBLIC

The Republic Organization can give you a complete service in steam power, fluid and heat measurement. Since pioneering the electrically operated flow meter, other control instruments have been added, but only when it was known that a real need existed. The addition of the new Republic Pyrometer now gives the Republic line exceptionally wide scope. A highly organized research department is constantly seeking improvement and progress—to build into Republic instruments those qualities that assure a service that makes Republic owners enthusiastic boosters.

DISTRIBUTION GAS AIR AND WATER

DRAFT INDICATOR

CO₂ RECORDER



A Dependable Pyrometer

The new Republic Pyrometer embodies the highest qualities that insure greatest satisfaction to the user.

***Note* these features**

(1) Every moving part mounted on a swinging bracket, thus tying all parts together as a unit.
(2) There is no other Duplex Recording Pyrometer having as wide a scale range—two charts, each six inches wide—therefore wider graduations and easier to read.
(3) Variable resistance—a 60-ohm rheostat—makes it possible to instantly and accurately adjust the instrument for changes made in the external circuit after installation.
(4) Visibility of record as soon as made.
(5) A tear groove directly at driving drum permits extraction of record without waste of chart.
(6) Has Highest Resistance of any Double Pivoted Pyrometer.

Bulletins on "Power Control" and "Measurement of Heat" sent on request.

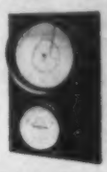
Republic Flow Meters Co., 2233 Diversey Parkway, Chicago, Ill.

Birmingham
Boston
Chicago
Cincinnati
Dallas
Denver
Detroit
Kansas City
Los Angeles
Milwaukee
New York
Philadelphia
Pittsburgh
Portland
San Francisco
Seattle
St. Paul
St. Louis
Grand Rapids
Salt Lake City
Cleveland

Republic System

Dominion Flow Meters Co., Toronto, Canada

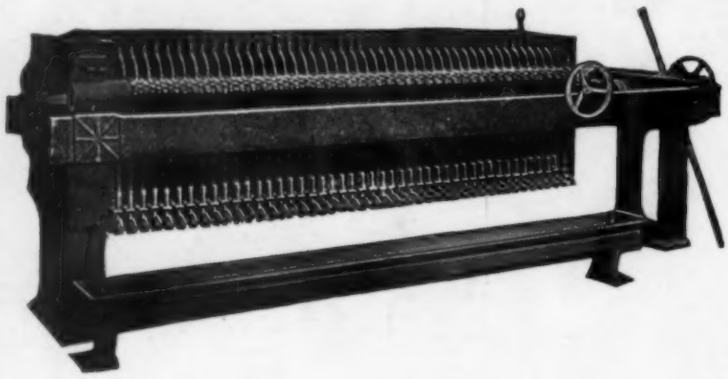
BOILER H.P. INDICATOR



RECORDING AND INTEGRATING INSTRUMENTS BOILER METER

COAL METER

INDICATING PYROMETER



SHRIVER FILTER PRESSES

are made in many styles, covering a wide range of filtration requirements. For special purposes our engineering staff will design special filter presses. It is the aim of this organization to sell a satisfactory and profitable *filtering service*, and the Shriver press that you buy must measure up to this standard.

T. SHRIVER & CO.

890 Hamilton St., Harrison, N. J.

The filter medium is just as important as the Filter Press. We sell specially woven filter cloths and filter paper at very close prices. We shall be glad to quote on your requirements.

DRYING MACHINERY

Chemicals, Colors, Dyes, White Lead, Lithopone, Magnesia Products

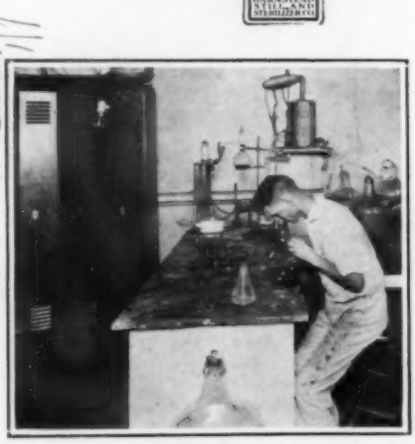
Pharmaceuticals, Soap, Ceramics, Grinding Wheels, Leather, Textiles, etc.

PROCTOR & SCHWARTZ, INC.

PHILADELPHIA.

1878

BARNSTEAD STILL AND STERILIZER CO.



"The best apparatus we know of," was the opinion expressed regarding this two-gallon-per-hour BARNSTEAD—when it was photographed after four years' service with the Barrow-Agee Laboratories, Inc., Memphis, Tenn.

Accurate Analysis depends on

the use of chemically pure water—obtained only by proper *distillation*.

In the Barrow-Agee Laboratories and those of many other analytic experts and consulting engineers throughout the Scientific and Industrial worlds, BARNSTEAD STILLS are part of the standard equipment.

A BARNSTEAD lasts indefinitely. The convenience of automatic operation, easy cleaning and low operating cost, are among its welcome features. Write for Handbook.

Barnstead Still and Sterilizer Co.

4 Lanesville Terrace, Boston, 30, Mass., U. S. A.

ONLY DISTILLED WATER IS CHEMICALLY PURE

BARNSTEAD WATER STILLS

CHEMICAL & METALLURGICAL ENGINEERING

McGRAW-HILL COMPANY, INC.
JAMES H. McGRAW, *President*
E. J. MEHREN, *Vice-President*

H. C. PARMELEE
Editor

Volume 32 — New York, February 16, 1925 — Number 7

The Technical School As a Consultant

THE incursion of technical schools and professors into the consulting field and the encroachment of government bureaus and laboratories on similar private endeavor have long been sore spots with consulting engineers and chemists. With more than a little justice they have complained of unfair competition on the part of the colleges and what seems to them unnecessary industrial activity in the government. Balancing the arguments on both sides, which have previously been discussed in these columns and need not be reviewed here, *Chem. & Met.* has been disposed to champion the consultant and support his cause. The principle seems sound that this individual should not have to compete with his alma mater which trained him for his work, nor with the government which he helps to support through taxation. Obviously the situation is more critical in some localities than in others and affects some individuals more vitally than others. Undoubtedly also the problem is most acute in certain areas of activity within which the consultant is most likely to be engaged and outside of which the educational institution and the government bureau find an important field of service.

That the difficulty is not insoluble is suggested by an article in this issue which merits the thoughtful consideration of all parties to the controversy. The experiment initiated at the Massachusetts Institute of Technology and developed over a period of 16 years to its present status is of more than academic interest. The "Tech plan" has not always borne its present favorable aspect; it did not spring fully developed from the mind of its sponsor. But in the course of its evolution it has embodied characteristics that give it outstanding prominence. As such it is commended to educators and consultants, who are cordially invited to discuss its features in the columns of *Chem. & Met.*

When Muscle Shoals Comes Out of Politics

AS THIS is being written Congress is pondering over the last few moves on the Muscle Shoals checkerboard. The long-drawn-out game nears its end —that is, from the standpoint of Congressional participation. The conferees from the House and Senate have finally agreed on a legislative measure that has been reported back to both houses with every indication that it will be passed promptly. Should this measure emerge from the realm of politics in substantially its present form a long step will have been taken toward an intelligent solution of this perennial problem.

The conference bill differs substantially from either the Underwood measure of the Senate or the House provision for the acceptance of the offer of Henry Ford. It resembles the former to the extent of providing, first and foremost, for a leasing arrangement with prime attention to nitrate production, and second, as a final alternative, for government operation in event that a suitable lease cannot be made within a reasonable time. Naturally it is the hope of the present administration—as well as that of an outstanding majority in and out of Congress—that progress will be made in the direction of the first alternative. Already there is evidence that at least three or four lively bidders will shortly be competing for the proposition. And such a competitive situation is the best possible insurance that the problem will be considered from every important angle.

It is apparent that the framers of the measure had as their primary motive the dedication of the nitrate plants for the national defense in time of war and for the production of fertilizers and other useful products in time of peace. As in both of the bills it supersedes, a definite schedule of nitrogen production is stipulated. By the end of the third year the annual production of fertilizers must contain at least 10,000 tons of fixed nitrogen and this must be increased to not less than 40,000 tons by the tenth year of the lease period. Additional terms governing the rate of annual production within this 10-year period are to be determined by the President, thus introducing a certain flexibility that technical and industrial conditions may make highly desirable. A significant innovation in the conferees' measure is the further provision that the President can authorize the substitution of fertilizers containing available phosphoric acid (measured as P_2O_5) for not more than 25 per cent of the total nitrogen requirements. Thus it would seem that a definite stimulus has been given toward a well-rounded fertilizer development that will take into consideration recent advances in the technology of that industry.

A program for research is also outlined in the bill, which requires that during the first 10 years of the lease an expenditure of not less than $50,000 must be made for "electrochemical research at Muscle Shoals having for its object the improved and cheapened production of fertilizer materials, and of war gas, light metals and other electrochemical or electric furnace products suitable for use in national defense." Furthermore, this is not to be confined to the laboratory, but must be extended to semi-commercial and commercial-scale investigation.

Other outstanding features include the limiting of the lease period to not more than 50 years and the establishing of an annual rental to be not less than 4 per cent of the total money the government has expended on the project. Definite terms are to be made under the leasing arrangement for the sale of surplus electric power generated at the plants. The fertilizers are to be sold at prices that do not exceed 8 per cent of their fair annual cost of production. But should the President be unable to make a lease under these terms before Dec. 1, 1925, the obligation to maintain and

operate Muscle Shoals must rest with the government. As in the case of the Underwood bill the conferees' measure sets up the Muscle Shoals Corporation of five men selected by the President and designated by him as the instrumentality for carrying out the provisions of government operation.

It has been our contention from the first that Muscle Shoals when viewed as a private industrial enterprise is in reality a comparatively simple problem. Its importance has been magnified by political harangue and the propaganda of the demagogues. But since Congress has stubbornly refused to leave the matter in the hands of a qualified commission, it is only to be hoped that in the final stages of negotiation the cloth will be out generously enough to provide sufficient leeway for intelligent administration. The conferees' measure is not entirely a patchwork of compromise and many of its older features represent the best that has gone before in the several years of bitter controversy. It offers a basis for constructive negotiation that will be welcomed both by industry and by those who have viewed the project solely from the standpoint of national defense.

Wood Preservation And Forest Economy

ONE-SIXTH of the entire timber consumption of the country is wasted through decay losses. Practical surveys of the situation show that at least half of these losses are entirely preventable. In the field of ties, fence posts, mine timber, poles and piling the preventable waste certainly equals 600,000,000 cu.ft. of wood per year that could be saved by proper preservation treatment.

This is a situation that demands immediate attention by chemical engineers. Railroads, telephone companies and other large users are beginning to take up tie preservation, pole treatment, etc. But the vast majority of wood users themselves have not given any consideration whatsoever to the purchase of treated timber or the treatment of timber. A great deal of selling must be done to show them that this is a public service that must be rendered and also a measure of economy to the individual concerned.

The technology of creosoting and zinc chloride treatment has gone far ahead of the application of these preservative methods. It is time for the purchasing agents and managers of corporations, as well as the engineers, to make use of these developments so that within a few years we shall not find ourselves in the embarrassing position of paying two or three times as much for our wood supplies as would have been necessary had we taken care to use with economy those stocks which we are today consuming.

As for the pulp and paper industry, government forest experts estimate that the annual pulp wood consumption of the country is about 585,000,000 cu.ft. of standing timber. At least 10 per cent of this cut is lost by decay, and half the decay loss can be avoided by care. Here is an opportunity for cutting pulp wood costs.

The pulp industry pays for this wood whether it becomes useful pulp or simply rubbish about the pulp wood stock piles. Proper piling and ventilation of stock piles will save much of the loss. Other well-recognized improvements in handling both the wood and the pulp will take care of most of the rest of the loss. There is a handsome opportunity in this field for the chemists and engineers of progressive pulp and paper companies to make dividends for their managements. Truly, pulp wood saved means dividends earned.

Norwegian Saltpeter Enters California

THE recent unloading at Los Angeles of one cargo of 2,300 tons of Norwegian calcium nitrate deflects attention to the fact that the synthetic product is successfully competing with the natural product in Chile's nearest market, in spite of Panama Canal rates and longer freight haul. The nitrate is used, mainly as a fertilizer, in southern California, Arizona, New Mexico and west Texas; it is made by the Birkeland-Eyde process, using the electric arc, the cheapness of production being due in large measure to the availability of ample natural power, one waterfall—the famous Rjukan Foss—supplying 300,000 hp. The Norwegian nitrate industry has shown rapid expansion since its inception in 1905. The product is used by some agriculturalists in preference to sodium nitrate, because of the value of the contained calcium; it is said to be particularly applicable in the case of peaty soils and for use with those of colloidal characteristics. From a fertilizer point of view, it is maintained that a comparison of the two products can be made strictly on the basis of nitrogen content. Any further stiffening of the price of Chilean nitrate will be welcomed by Norway.

Reserves of Nitrate In Chile's Residue Dumps

IT IS sometimes possible for a player to deduce what cards are held by his opponent, but it is a difficult matter to win the game with one's hand exposed. This may account for the insignificant reference in reports and in the literature of the subject to the reserve of nitrate in the residue dumps on the Chilean pampa, a reserve that evidently constitutes a trump card in the hand of the nitrate producers, to be played at the appropriate time. To expect that it will be played eventually is to expect the obvious—we have that much confidence in the ability of modern chemical engineering methods. A discussion of the subject will be of particular interest to those concerned with the establishment of a competitive industry based on the manufacture of synthetic nitrogen compounds.

Sir William Crookes' prophecy, made in 1898—that the reserves of natural nitrate were then approaching exhaustion at an alarming rate—was repeated so often during the expiration of the allotted span of life given to the Chilean industry that it became an accepted fact. Even as recently as 1921 a distinguished American chemist quoted, in a book that had an exceptionally wide circulation, the U. S. Department of Agriculture as sponsor for the statement that the beds would be exhausted "in a few years." More recently, however, the truth has prevailed, as it does occasionally, and it is now generally admitted that the reserve is immense, sufficient for many generations. In an effort to estimate the possible cost of producing nitrate, the United States Government sent two engineers to Chile in 1923, one of whom was the director of the U. S. Bureau of Mines. Their report, released early in 1924 by the U. S. Department of Commerce, confirmed the contention as to the large reserve of untouched caliche, or

nitrate-bearing rock; but little was said about the reserve of nitrate in the residue resulting from the primitive methods of beneficiation that have prevailed until comparatively recent years. The Inspector General of Nitrate Deposits for the Chilean Government was quoted as admitting that "No attempt has been made to estimate the amount of the 'tierras,' 'borras' and 'ripios'; however, there is no doubt their aggregate bears a content of many thousand tons workable nitrate." This estimate, so vague as to be valueless, may be placed among "red-herring" statistics; although the United States investigators appear to have accepted the opinion at its face value. By taking the Inspector General's guess of "workable nitrate" content of all discarded material, after sorting as well as after treatment—a liberal interpretation of "many thousand tons"—we find that the average extraction of nitrate has exceeded 99.8 per cent!

It is possible, we believe, to estimate roughly the contents of these dumps by arithmetical deduction, using unquestioned statistics as the base. The total production of nitrate to date has been about 70,000,000 tons. The loss in treatment prior to the adoption of more efficient methods on an insignificant scale in recent years is estimated by authorities as varying from 35 to 50 per cent. Even the United States Government engineers placed the average loss at 35 per cent. In order to be on the safe side, taking into consideration the fact that a small amount, the richest material, handled in the early days of the industry has been re-treated (also by inefficient methods, let it be remembered), the loss is taken at the exceptionally low figure of 20 per cent. This means that ripio containing 17,500,000 tons nitrate, valued at about $800,000,000 (U. S. currency) is available for immediate treatment alongside plants that can be modified at small expense for its handling by efficient and modern chemical engineering methods. The essential equipment does not deteriorate in the arid atmosphere of the pampa; or larger, sectionalized leaching units may be built at comparatively small capital outlay. A second point from which attention is systematically deflected is worth emphasis: The immense residue reserve of hand-picked material makes possible the treatment, by blending, of high-grade but slimy caliche that was discarded before mining or during sorting, and considered valueless before the basic fundamentals of efficient leaching practice were appreciated in Chile.

There is a wide difference between 17½ million tons and "many thousand tons." Where is the nigger in the woodpile? We confess we do not know. Discussion of the subject is usually closed by an expression of credulity; but the fact is evident that, despite the value of the reserve as indicated by circumstantial evidence, no dump of any appreciable size has been sampled. Nitrate operators, peeved at the insistence of technical reform, naturally do not wish them sampled. The sponsors of complicated treatment processes, in the application of which no existing equipment can be utilized, are not interested. The contention that the nitrate in residue dumps has been washed into the ground is unconvincing. The claim that it is associated with too much refuse lacks conviction. No other similar industry has been influenced by such arguments to neglect so obvious a source of revenue. The reserve, we believe, constitutes a trump card to be played by the nitrate producers when the time is ripe.

More Light Still Needed by Industry

THE important relation that proper illumination bears to efficient production in office and factory is finally commanding the attention of industrial executives. As yet, the optimum intensity of illumination for specific conditions is unknown to most consumers of electric light. The initial work in illumination engineering was the natural outcome of intelligent sales service on the part of lamp manufacturers and electric power companies. The present trend of selling illumination in terms of increased profits has replaced the old idea of marketing lamps and power as such, without regard for the buyer's technical problems.

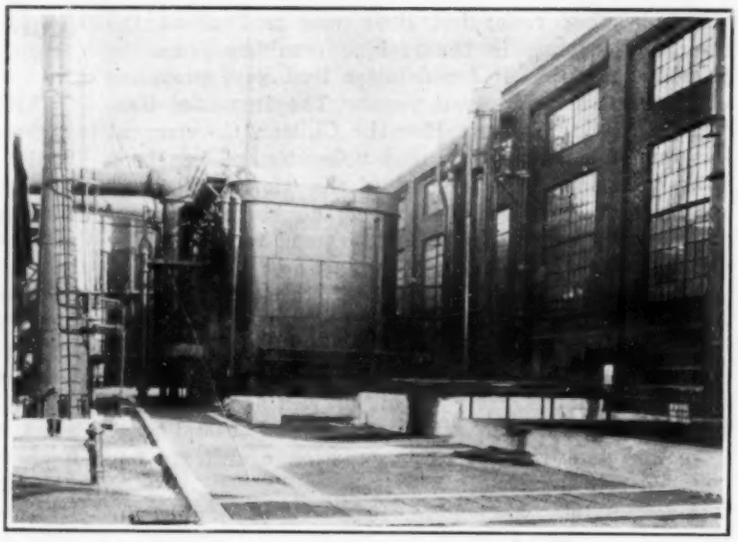
At least one electric equipment manufacturer has made a thorough study of the proper intensity of illumination for various industrial operations, with distinctly worth-while results. For example, it was found that one-eighth of the average workman's energy is expended in exercising the sense of sight, showing quantitatively the possibility of lessening fatigue and the resultant defective work and decreased production. Another possible gain from adequate illumination is the prevention of one-fourth of industrial accidents. Further advantages are greater cleanliness in the factory and better supervision of workmen.

There is, of course, an optimum intensity of illumination for any given set of conditions, but as yet this point has not been reached by industry in general. The chances are that individual plant investigations for the purpose of determining this optimum will indicate an added expenditure for lighting. The excellent research initiated by the electrical industry should be extended by executives of individual plants in order to find the economic balance between the cost of illumination and increased profits.

Reasonable Care In the Purchase of Coal

IN MOST organizations, as well as in individual men, we are accustomed to encounter that peculiar phenomenon that might be referred to as a "blind spot," that inability to recognize the importance of one of the several factors that contribute equally to the success of any enterprise. The factor in the chemical engineering industries that usually constitutes the blind spot is the power plant, and the blindest part of that particular blind spot is concerned with the purchase of coal.

The manner in which many plants purchase their coal supply is strongly reminiscent of the celebrated "Gimme a quart of oil" advertisement. This is a great mistake, for as much care should be used in selecting and specifying a coal for steam-raising purposes as is used in the purchase of any other raw material. Some of the important considerations involved are brought out in a paper published in this issue by Prof. D. J. Demorest. The relative importance of B.t.u. content, cost per B.t.u. in the raw coal, fusibility of ash, ash content, sulphur content, phosphorus content, and cost of B.t.u. delivered in steam enter into the choice of a coal. Economy results only from a nice balancing of all these factors. But such economy means many dollars saved; and the care in specifying and purchasing coal upon which this economy is based cannot be neglected by the management that is to be really successful.



RIGHT—The gas, on coming from the coke ovens, passes first through the primary coolers, shown at the center of this picture, in which most of the tar is extracted, after which it enters the byproduct house on the right.

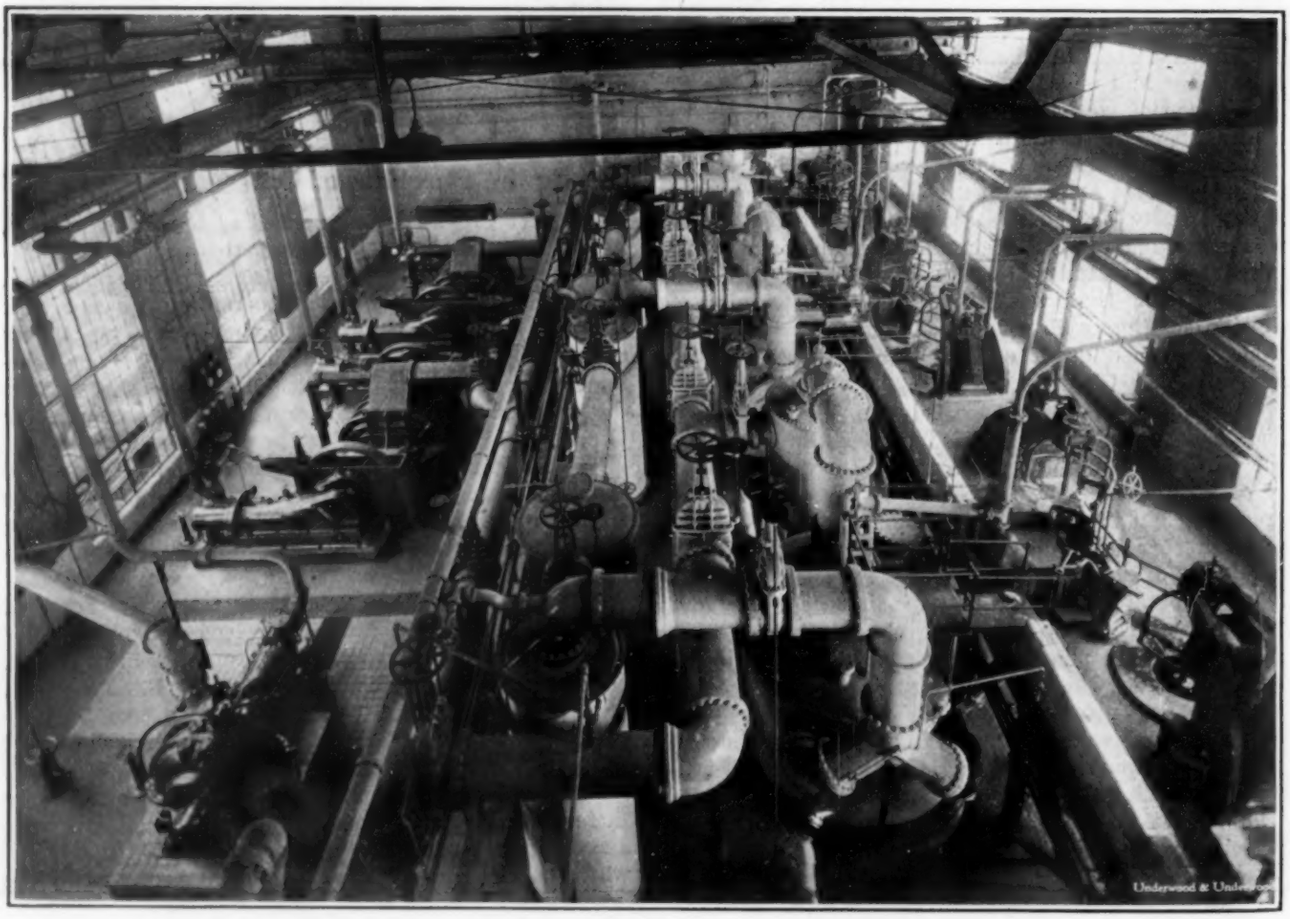
BELOW—Inside the byproduct house the layout is shown in this picture, with the exhauster that sucks the gas from the coke ovens on the left, next the tar extractors, the reheaters, the ammonia saturators and finally the sulphate of ammonia centrifugal driers.

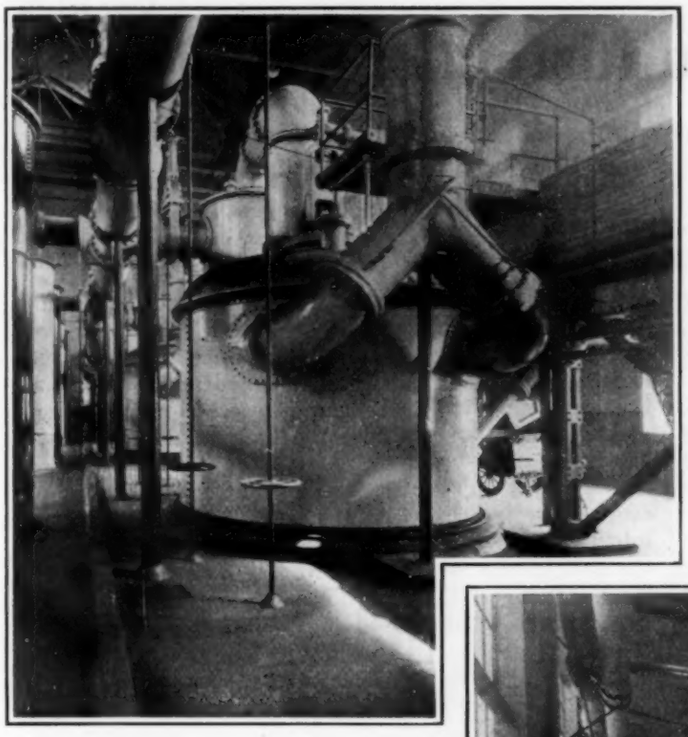
A Chemical Plant That Is Different

WHEN an industry is firmly established on a profitable basis and has been so established for years, when the process of production is in the main fixed and the only changes that are made are changes in detail, then there is both the time and the opportunity for an intensive study of equipment and a perfection of operation such as are not possible in the average chemical plant.

Such an industry is the byproduct coke industry—in all essentials chemical industry, but so specialized as to be generally considered in a class by itself. Here intensive study has resulted in a straight-line layout, in the extreme simplification of operation and in such perfected equipment that attendance has been reduced to a minimum. As a result, though a general rise in prices has been experienced with the products of most chemical industry, coal byproducts have remained fairly stable in price over a long period.

The pictures on this page, showing part of the Koppers Co. plant of the Seaboard By-Products Coke Co., Kearny, N. J., will serve to indicate the simplicity and clean-cut design of such a plant. The absence of workers is not due to a shut-down, for the plant was in full operation when the views were taken. It does indicate, however, the small amount of attendance necessary in this type of plant.

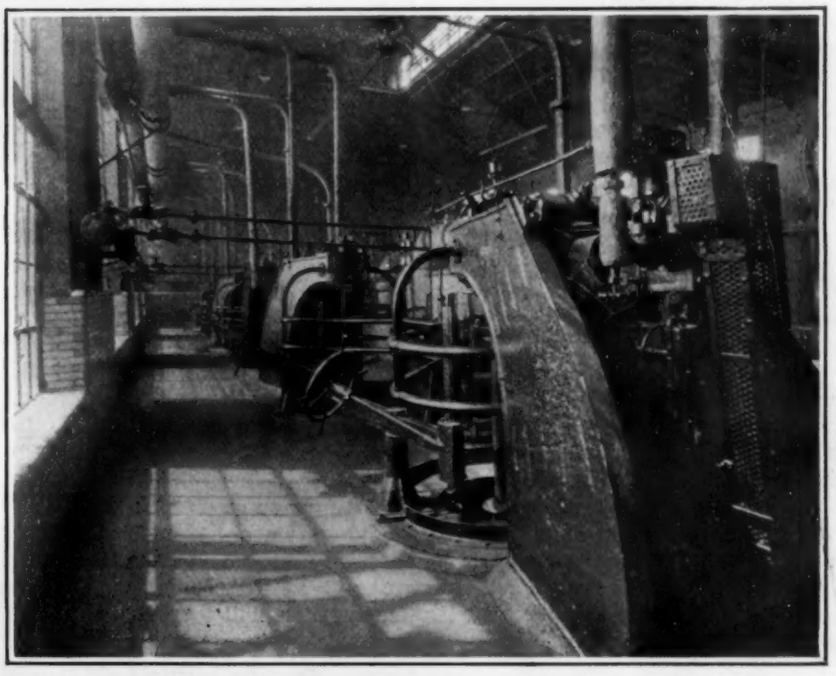




Close-Up of Ammonia Saturator

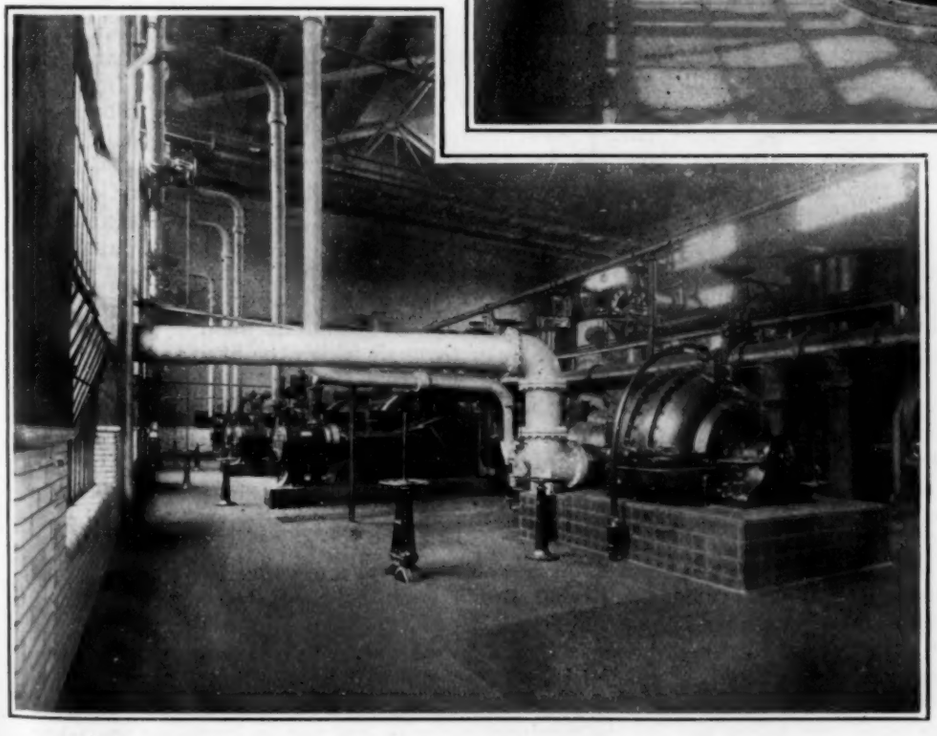
The exhauster that sucks the gas from the coke ovens through the primary coolers, delivers it with sufficient pressure to pass through the remainder of the byproduct house. It first passes through the tar extractor, where the tar not removed in the cooler is taken out, then through the reheater, and then the heated gas is caused to bubble up through a bath of sulphuric acid in the saturator. This later operation forms ammonium sulphate, precipitated as crystals, and the gas passes on ammonia free.

Photos © Underwood & Underwood



Centrifugal Driers for Ammonium Sulphate

The ammonium sulphate crystals are collected on a draining table, after being taken out of the saturator. The liquor that drains off is returned to the saturator and the crystals are placed in the centrifugal, where they are whizzed until, at discharge, they contain less than 0.05 per cent of H_2SO_4 and 2.0 per cent of moisture.



The Exhausters in the Byproduct House

The operation of coke-oven exhausters requires most careful control. The suction on the coke ovens and the pressure on the gas after it reaches the saturators must be controlled within close limits, while the resistance to the passage of the gas through coolers and tar extractors varies. This delicate problem in governing has been satisfactorily solved.

Coal as an Industrial Fuel

A Discussion of the Factors Determining a Choice of Coal for Boilers, Producers, Coke Ovens, Gas Works and Powdered Fuel Installations

By D. J. Demorest
Professor of Metallurgy, Ohio State University

THE ECONOMIC PURPOSES to which coals may be put may be roughly classified into steam coal, domestic coal, producer coal, gas coal, coking coal, bunker coal. In steam coal the important characteristic is, of course, its B.t.u. value. But of almost equal importance are the fusibility and amount of the ash. An excellent coal from the B.t.u. standpoint may give great trouble in the boiler if its ash is highly fusible, by forming a mass of clinkers on the grates. This means increased labor to keep the grates open, cuts down the capacity of the boiler by decreasing the amount of air that can be drawn into the burning coal and causes the loss of heat up the chimney to be excessive by making it necessary to have the furnace door open a great deal of the time to remove clinkers. Given two coals of the same B.t.u. value but one having a more easily fusible ash than the other, the purchaser can afford to pay a higher price for that with the most difficultly fusible ash.

The temperature below which an ash must not fuse to avoid clinkering troubles depends upon the kind of stoker used and upon the percentage of its nominal rating at which the boiler is operated. Very few coals possess ash that fuses below 1,900 deg. F. and very few have ash that fuses above 3,100 deg. F. In general it may be stated that ash that fuses above 2,600 deg. F. will not cause clinkering troubles, those that fuse between 2,300 deg. F. and 2,600 deg. F. will generally give no serious trouble, while those that fuse below 2,200 deg. F. will be troublesome and increasingly so as the fusion temperature is lowered. It should be remembered, however, that different types of stokers give different amounts of clinker trouble with a given coal. A side-fed overhead mechanical stoker, for instance, will give serious trouble when using a coal whose ash fuses below 2,200 deg. F., while a chain grate stoker could probably handle the ash from the coal without special trouble. The reason is that the ash of the coal becomes soft and gummy and when it reaches the bottom of the V where the clinker breaker is it has so gummed together as to arch across the bottom and the breaker cannot touch it. The grate then soon becomes filled with a mass of stuff that prevents the free flow of the coal and stops the draft, and the steam pressure drops quickly. The gummy mass must be raked out by hand (an unpleasant job) and the boiler cannot carry the load for a while. A chain grate stoker would have carried the clinker to the end of the firebox and dropped it and there would have been no chance of heaping up a mass of mixed clinkers and coal, stopping the draft and flow of coal as in the side-fed overhead mechanical stoker.

The behavior of coal when heated also has some effect upon its value for steam raising. Some coals tend to cake badly and to reduce the effectiveness of the draft, others burn slowly like anthracite and require large grate area, others give off very large amounts of volatile matter and cause excessive smokiness unless an extra large combustion chamber is provided. Hence what is the best coal for one boiler and stoker may not be the best for another. Or, vice versa, when a given locality can obtain a certain coal cheaper per B.t.u. than any other it is necessary to use a certain type of stoker and boiler to secure the best results with that particular coal.

The coal to buy for any steam plant installation is, of course, the one that puts the largest number of B.t.u. into the steam per dollar. With a given price for coal the coal to buy is the one with the largest number of B.t.u. per pound, the most difficultly fusible ash and the least amount of trouble-giving resulting from the coking and volatile-matter-yielding nature of the coal. In other words, it is not sufficient to consider the B.t.u. per dollar of coal cost alone. The right coal is the one that yields the most steam per dollar of operating cost.

Producer Coal

The qualifications required of a coal for use in a gas producer are much the same as those required of a steam coal with added limitations of size, sulphur and caking tendency. Producer gas can be made from practically any coal from anthracite to lignite, but some coals are gasified in producers so much more satisfactorily than others that these are always preferred unless freight and other costs are too high. It can be said in general that the higher the B.t.u. value of a coal the better the coal will be for producer operations, and the lower the ash percentage and the higher the fusion temperature of the ash the less will be the difficulties encountered in operating the producer. Freedom from clinkering troubles is of even more importance in producer operation than in stoker operation, for it is difficult to get at the clinkers in a producer. The laboratory determinations of ash fusibility are sometimes misleading, because laboratory tests are always made on finely ground samples, while if the ash particles in the coal are coarse, they will react with one another relatively slowly and will not give clinker troubles as they would if finely disseminated in the coal and therefore rapidly reacting. If the coal cokes too readily, it cakes in the top of the producer, making a relatively impervious layer through which the blast is blown with difficulty. For most satisfactory producer operation the coal should be sized, egg, nut and pea coal giving satisfaction. For heating glass tanks, lime kilns, coke ovens, copper reverberatories, brick kilns, etc., the sulphur content is not of much concern, although it is always desirable to have it low in the coal, as it all goes into the gas.

Just as in operating a steam boiler the coal to buy is the coal that will give the most return per dollar of operating cost, not per dollar of coal cost. It very often happens that a low-priced coal gives so much operating trouble that although it may have a high B.t.u. value per dollar invested in coal, yet it so reduces the capacity of the producer to make gas and so increases the labor

and repair bills per 100,000 B.t.u. in the gas that it really is a very expensive coal. On the other hand, the writer knows of several cases where a high-grade expensive coal has been discarded in favor of a lower grade but much cheaper coal because the cheaper coal gave a greater number of B.t.u. per dollar of over-all operating costs than the higher grade coal.

Price of coal not considered, the best producer coal is a high volatile, not too strongly caking, low sulphur, low ash, high ash-fusion-temperature, high B.t.u. blocky coal. How far one departs from this ideal coal depends upon the relative prices of the best coal and poorer coals delivered at the producer plant.

Coking Coals

For steam raising and producer operation the really primary demand is for B.t.u. content, but for coke making the primary interest is coke quality and quantity. Given proper coke plant operation, the quality of a coke is dependent upon the freedom of the coals used from sulphur, phosphorus and ash and upon the nature of the organic constituents that make up the ash- and moisture-free coal substances. Fusibility of the ash is not of so much importance in metallurgical coke. The quantity of the coke that is obtainable from a coal is roughly proportional to the "fixed carbon" that it yields, which in turn depends upon the nature of the organic constituents of the moisture- and ash-free coal and the free carbon naturally in the coal.

It can be safely stated that the organic material of coal is chiefly of two kinds—cellulosic or non-fusing and resinic or fusible. If the coal is chiefly of the first kind, then it merely forms a weak, easily powdered residue when retorted or carbonized. If it is chiefly of the second type, it melts too readily to form a good coke and produces a highly porous vesicular coke. The first type is high in oxygen and low in available hydrogen, while the second is low in oxygen and high in available hydrogen. In general the best coking coals contain around 25 to 33 per cent of volatile matter and a hydrogen-oxygen ratio of above 0.58, as shown by David White. However, few coals possess the ideal composition and if we were limited to the ideal coking coals, we should be hard pressed, indeed, to supply coke for our blast furnaces and foundries. Fortunately, it is quite satisfactory to mix high volatile and low volatile, high oxygen and low oxygen, high resinic and low resinic coals and then get a mixture that has sufficient "meltability," but not too much, to make entirely satisfactory coke. It will be seen, therefore, that it is exceedingly difficult to define "byproduct coking coal," for there are few coals that are, when used alone, satisfactory coals for making byproduct coke and on the other hand, there are few bituminous coals which (when low in sulphur, ash and phosphorus) will not, when properly mixed with other types of coal, be useful in the byproduct coke industry. Usually, at least three different coals are mixed at byproduct works to make a satisfactory coke and it is this ability to effect desirable qualities in byproduct coke by judicious mixing of coals that has made byproduct coke so highly regarded. Next to the necessary coking properties the important requirements for coal that is to be used for coke making is low ash and sulphur. The sulphur should be under 1.25 per cent. The ash should be under 8 per cent. It has been proved by the Southern Ohio Pig Iron and Coke Association that a lowering of 1 per cent in the ash of the coal to be used for making metallurgical coke lowers the cost of pig iron making about $0.30 per ton. It is obvious, therefore, that when one is buying coal for coke making he should select the lowest ash coals, other things being equal. It is profitable to the buyer to pay, say, $0.10 or $0.15 more per ton per each per cent of lowering of ash for a coal of low ash than for a coal of high ash. And it is also profitable for the operator to add something to the cost of mining if he can thereby improve his coal by getting it cleaner and sell his coal at the higher price that such coal is undoubtedly worth. More attention will be given to this as soon as the coal buying and selling public are familiar with the facts. Methods for the cleaning of coal or, in other words, the lowering of the amount of ash and sulphur in the coal, are being rapidly developed, especially by the use of pneumatic methods and by the sand-water displacement method, and we feel that the public will soon force coal producers to clean their coals.

Gas Coals

When gas is made in byproduct ovens, the coals are selected and mixed to give the best coke, although the gas that is driven off is highly usable and has a ready sale if the coke works is near a large city or industrial center. The other byproducts—tar, ammonia and light oils—are also valuable, but the coals are not selected primarily for their ability to make the best gas and byproducts.

For operating a gas works the coal is selected primarily for its gas-making qualities, but the quality and salability of the coke and other byproducts are kept sharply in mind also because coal gas cannot be made at a price acceptable to the public unless the gas company can readily sell its coke at a good price (about $2 per ton net above the price of coal per ton). In selecting coals for gas making, therefore, it is necessary to keep in mind both gas-making and coke-making qualities, although the gas is of primary interest. The coke that is sold for domestic consumption does not need to have the same qualities as coke for metallurgical uses. Domestic coke does not need to be so lumpy or strong as metallurgical coke, and phosphorus and sulphur are not important, but the public demands a low ash and a difficultly fusible or non-clinkering ash.

Sometimes special and temporary considerations enter into the selection of coals. For instance, when toluol was in high demand during the war for making TNT the high volatile coals were used as much as possible because they yield a higher amount of toluol in the "light oils" than low volatile coals.

Generally speaking, coals for making "coal gas" should be low in sulphur and ash, should yield the highest possible number of B.t.u. in the gas, should carbonize as quickly as possible and yield good coke with a low amount of ash of high fusion temperature. The gas coals will usually give the following results:

Fixed carbon 52 to 72 per cent—	Preferably around 58 per cent
Volatile matter	32 to 38 per cent
Sulphur	Under 1.25 per cent
Ash	Under 8.00 per cent
Gas	10,500 to 12,000 cu.ft.
B.t.u. in the gas per ton of coal	6,000,000
Coke yield	1,300 lb. per ton
H/O ratio	Above 0.59

While one can make a pretty good guess as to the probable gas- and coke-making qualities of the coal from its analysis, there is only one way to tell for sure

and that it to make a test under commercial conditions. Just as in the case of coals to be used for other purposes the value of a gas coal depends upon what can be obtained from it per dollar of operating cost and it frequently is best to use a somewhat inferior coal which is obtainable at a reduced price. Since the advent of the "Seaboard" liquid purification process the limitation on the sulphur content of gas coals need not be so strict —indeed, the sulphur may turn out to be an asset rather than a liability.

The coke made at gas works is partly sold to domestic consumers and partly used at the works for water gas generation. However, some gas plants are using raw coal for water gas generation. Coals that are good producer coals would be eligible for consideration as water gas generator coals, but an actual test should be made before a decision is arrived at.

Powdered Coals

The use of powdered coal is rapidly becoming an important factor in industrial heating in spite of the fact that it costs considerable to prepare the coal in the powdered condition. The reason for this increasing popularity of powdered coal is that it is handled and burned in much the same way as gas is handled and burned and therefore has many of the advantages of gas combined with the low cost of coal.

The cost of preparing coal in the powdered condition depends, of course, on the kind of coal used, fineness of the powder and the scale of operations. A strictly up-to-date plant powdering 500 tons of coal per day reports that its over-all cost is around $0.70 per ton of coal. A plant powdering 1,000 tons per day reports its cost as around $0.60 per ton when operating at capacity. The costs are, of course, higher when the load factor is low.

Powdered Coal for Boiler Heating. The only advantage of powdered coal-firing of steam plants over stoker-firing are: (1) It is possible to burn powdered coal with a very low excess air and still get complete combustion. This results in a minimum loss of heat up the chimney, increased boiler capacity and higher fuel efficiency. The air excess may be as low as 15 per cent. (2) It is easy to regulate the rate of firing to the fluctuations of the demand for steam. This regulation may be done automatically and as quickly as if gas were used and it follows that it is easy to bank the boilers during no-load periods. There are some disadvantages to the use of powdered coal at boiler plants. The burning of powdered coal is slow compared with the rate of combustion of gas and it is necessary to provide a very large combustion chamber so that the combustion may be complete before the flame reaches the boiler tubes. This is overcome to a considerable extent by more finely powdering the coal and by using a multiplicity of burners of large cross-section so that the coal-air mixture floats into the combustion chamber slowly. There is some explosion hazard in the handling of powdered coal, but this hazard has been almost completely overcome by the perfection of the mechanical details of handling the powdered fuel. The greatest drawback to the use of powdered coal in steam power plants is the ash trouble. A part of the ash, possibly 20 per cent, either settles or fuses in the bottom of the combustion chamber, from which it can be reasonably easily removed. A part settles on the boiler tubes and brick of the baffles and setting, whence it can be easily removed by steam blowers. The rest of the ash, possibly two-thirds of all the ash of the coal used, including the dust blown out by the steam dust-blowers, must pass up the chimney and settle over a great area of neighborhood, where it is sure sooner or later to cause trouble, including law suits. Since modern stokers are being so greatly improved that they can be operated with a low excess of air and can be automatically regulated to respond to the fluctuations of the demand (though not as readily as powdered coal) and since the cost of powdering and handling coal is decidedly greater than the cost of operating stokers and handling slack coal, there is not a very great margin of economy in steam-raising by powdered coal over that by stokers. It seems doubtful, therefore, to the writer if the margin in favor of the use of powdered coal is sufficient to justify the use of powdered coal in power plants near cities where the ash dust will create a nuisance.

Powdered coal heating is ideal for certain industrial operations. Rotary cement kilns can be heated more cheaply by powdered coal than by its only competitors, producer gas or oil. Copper reverberatory smelters are especially well adapted to the use of powdered coal and this fuel has displaced all others except in the Southwest, where oil has been obtained so cheaply from Mexico and California.

Pulverized coal can be used efficiently for heating, reheating, forging and annealing at steel mills provided ash contamination will not be serious, although the writer believes that the claims of some of the powdered coal enthusiasts concerning the efficiency of powdered coal in these furnaces are extravagant.

One of the outstanding advantages of powdered coal for industrial furnace heating is also one of the chief advantages of gas for the same purpose; it is the fact that powdered coal can be prepared in a central plant at a large manufacturing works and piped about the works about as well as gas can be piped. At the furnaces where the coal is used the powdered coal can be discharged into small bins and fed into the burners by a screw conveyor operated by a variable speed motor or it can be fed directly into the burners without using a bin. In this second system the powdered coal is carried through the pipes of the distributor system by being suspended in air traveling at a rate of 5,500 cu.ft. per minute and using about 50 cu.ft. of air per pound of coal.

This central pulverizing plant can be likened to a central gas-generating plant, each with its own distributing system. There can be no question that the gas burning is cleaner and more satisfactory than the powdered coal burning but, on the other hand, from the point of view of fuel economy, more work can be accomplished by a pound of coal in the powdered coal system than by a pound of coal first gasified and then purified and distributed, provided the furnaces that are to be heated are of such a nature that they can use powdered coal, which is sometimes impossible. As an example, powdered coal would be ruinous when used to heat a coke oven or gas retorts because the ash of the coal would soon ruin the ovens and retorts. The use of recuperators and regenerators is rapidly extending in industrial heating operations, because of the great saving that can be accomplished. Powdered coal does not lend itself well to the use of recuperators or regenerators, because the ash of the coal is so troublesome in these appliances, which are, however, wonderful money savers when used in connection with gas-fired furnaces.

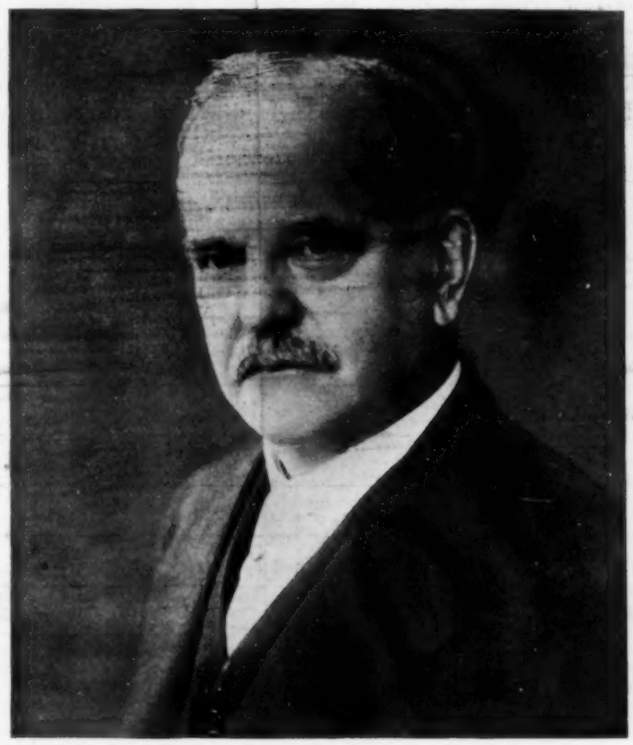
Before the Chemical Engineering Era

The Penn State Course in Industrial Chemistry Was a Prototype of the Modern Chemical Engineering Curriculum

By Charles Wadsworth, 3d
Managing Editor, *Chem. & Met.*

This article is the third of a series on chemical engineering education. The purpose of the series is twofold—to promote a discussion of educational methods so that the curricula of chemical engineering will equip students adequately to meet the needs of industry and to acquaint the technical men of industry with the progress that has been made in chemical engineering as reflected in these courses. Four courses representing four types of institutions have been selected. The first, "Chemical Engineering at Michigan," appeared in "Chem. & Met.," Dec. 29, 1924. The second, "How M.I.T. Makes Chemical Engineers," was published in the Jan. 26 issue. The series will be completed next week with an article on the Columbia course in chemical engineering and a short summary. My thanks are due Dean Wendt of the School of Chemistry and Physics and Dr. Chandler of the Department of Chemical Engineering for their interest in this historical narrative that has neglected their own excellent efforts in chemical engineering education at Pennsylvania State College.

THIS analysis of the course in Industrial Chemistry at Penn State is not quite fair to the college. It does not discuss the present chemical engineering curriculum, which is undergoing a healthy change, but deals with the course called Industrial Chemistry developed under the late Professor George Gilbert Pond. In other words, it discusses a course that no longer exists, that has been superseded by a more modern curriculum. Yet for our purposes the course developed by Professor Pond represents a type that deserves recognition and study. It is a prototype of the modern course and it illustrates how much can be accomplished by a man in a college—as distinguished from a technical school or a university—and with limited facilities. There need be no hesitation in stating that Professor Pond's students were well equipped for careers in industry. But industry has changed, and so must any curriculum if it is to fit men for the changing demands of industry. Yet Professor Pond illustrates more clearly than a dozen treatises the paramount importance of the man rather than of the curriculum.



The late Dean George Gilbert Pond of Penn State

At Penn State there was no course in chemical engineering, or perhaps it would be better to say there was no course called chemical engineering. But the men for the technical work of those industries that have come to be called the chemical engineering industries were trained in two ways, and behind both of these is a story of a personality.

For years, even generations, Penn State men grew wise chemically under Professor Pond, a man of great talent and with a keen industrial sense. As a consulting chemical engineer and chemist he came closely in touch with explosives, with dyes, with oxy-acetylene welding and many other products of industry. Another picture will add color and perspective to his personality. It was through his interest, his initiative and his energy that American chemists have, as permanent memorial, the old Priestley homestead at Northumberland. Dr. Pond collected the money with which the stately old mansion was purchased and was instrumental, through the Penn State Chemical Alumni, in having it restored and maintained. Through him future generations will benefit by an understanding of Priestley and the atmosphere of his culture. Under his direction there grew up and thrived a course in "Industrial Chemistry" that finally became a curriculum by a vote of the board of trustees. It is still retained under the jurisdiction of the dean of the School of Science, and this is not an accident—it is an approved policy. The board of trustees indorses the idea that it should be predominantly a science course, and so it is. Throughout 4 years less than 18 per cent of the time is spent on engineering subjects such as

mechanical drawing, mechanics, heat engineering, engineering materials, electrical engineering, etc., whereas chemistry comes in for more than one-third of the total time. The ratio 2:1 of chemistry to engineering stamps it as a predominantly science course. It was Professor Pond's belief that industry wanted and needed men trained in the fundamentals of science and above all things not specialists in any one branch of technology.

There was another course at Penn State. It was called Electrochemical Engineering. It was organized under the department of electrical engineering in the School of Engineering. It began 'way back in 1905 when R. L. Myers, now chief engineer of the Westinghouse Lamp Works, was asked by Prof. J. P. Jackson of the electrical engineering department to teach the electrical engineering students a few subjects such as batteries, welding, electrometallurgy and electrochemistry. In the course of a few years these subjects had expanded and it was recognized that here was a field of specialized technology about which little is taught and in which there is a constant and steady demand for high-grade technologists. Therefore a curriculum leading to a degree of B.S. in Electrochemical Engineering was established. The course is a combination of all the electrical engineering theory with all of the chemistry given to the industrial chemists for the first 2½ years and in addition the four special courses in Electrochemical Engineering, including Electrometallurgy. The ratio of chemistry to engineering was roughly 1:1. The course tolerated only first-class men and was an extremely severe one, but the few graduates each year were in demand.

These two courses seem far apart in conception, and they were. One gave a broad training in fundamental science and sought to avoid the thing that the other course set out to do—namely, train specialists.

Space does not permit us to study the course in Electrochemical Engineering, interesting as this would be. To the casual observer it seemed to have considerable merit, though it also had of necessity the faults of a course that specialized. The relatively few graduates fitted into the needs of a specialized group of industries, but it seems as though such specialized training should come rather from the industry than from a school.

If we study the schedule or program of the course in Industrial Chemistry, it will be found to possess many of the earmarks of a course in Chemical Engineering of the best modern type. In general the small amount of engineering is noticeable and deserves analysis, as does also the complete absence of any chemical engineering as such. But it must be remembered that courses in Chemical Engineering, by which we mean a study of unit processes rather than of descriptive industrial material, are comparatively new. Even now many courses labeled Chemical Engineering are nothing but chemistry in a disguise. And even unit process studies often degenerate into a meager description and handling of small-scale equipment. Chemical Engineering is not a label, it is a point of view from which technology can be most advantageously understood.

But to return to the curriculum. No educator can or should take exception to emphasis on English composition, oral and written. It was higher than average. Should it not be imitated rather than decried?

The time devoted to modern languages was about average and the required familiarity with scientific German is characteristic of present-day curricula. The two courses in economics and government are not unique and will serve to remind some educators that it is important for students to become familiar with the common basis of all industry.

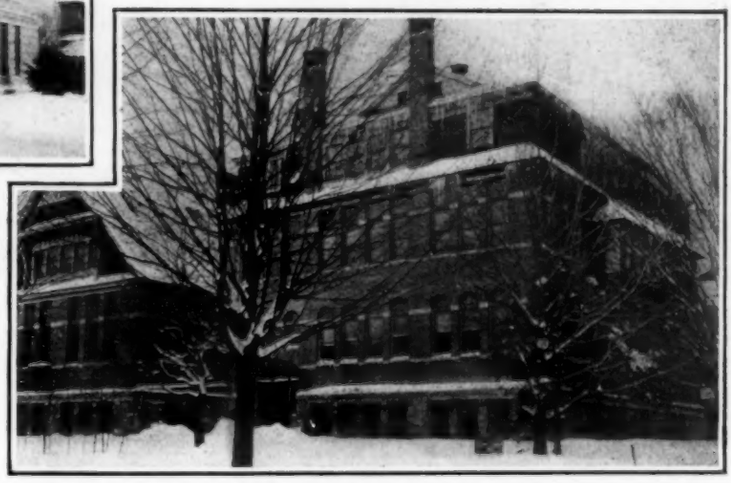
In addition to the general course in physics there was added a short course in heat and temperature measurements in the third year. This is variously listed in other schools as an engineering subject and even as a chemical engineering subject. There was a slightly greater emphasis of mathematics in Pond's course than in modern courses, due largely to a slower start.

	1st Year	2nd Year	3rd Year	4th Year	Total	
English	Composition 3	Oral Comp. & Literature 1½			4½	5.6
Mod. Lang.	French or German 3				3	3.7
Economics			English & American Economic History 3	Economics & Government 3	6	7.4
Physics		Mechanics, Heat, Elec. & Mag. & Lab. 4	Heat & Temp. Meas. 1½		5½	6.8
Mathematics	Trig. & Anal. Geom. 4	Calculus 3			7	8.6
Chemistry	Gen. Chem. 2 Carbon Compounds 1½ Qual. Anal. 2	Quantitative Anal. 6½ Organic Chem. 3	Inorganic Preparations 1½ Physical Chem. 4 Organic Chem. 1½	Industrial Chem. & Lab. 5½ Organic Chem. 1½	29	36.0
Engineering	Mech. Drawing 1 Shop Work (Wood) 1		Steam Eng. & Boilers 2 Mechanics 2½ Hydraulics 1½ Eng. Materials 1	Electrical Eng 4 Power Plant Eng. 1	14	17.2
Chem. Eng.			Gas Analysis ½	Applied Electrochem. & Lab. 2	2½	3.1
Miscellaneous	Phys. Training 1 Military Science ½	Military Science 1	Mineralogy 2 Industrial Organization ½	Metallurgy & Assaying 4½	9½	11.6
Total	19	19	21½	21½	81	100.0

The Penn State Course in Industrial Chemistry Under Dean Pond

Trigonometry is usually required at entrance now and analytical geometry combined advantageously with calculus. At Penn State the curriculum brought the student up to the same point, but had to teach him trigonometry during the first year.

Pond's first contact with the students in Industrial Chemistry began as soon as they matriculated. General Chemistry was the name of the course, but it was known as "Swampy's course" and it was a man-killer. By mid-year the heroic remnant of those that entered Industrial Chemistry breathed a sigh of relief and hoped for the best. But the baptism of fire served to burn away the chaff, the incompetent and the dilettante. During the second half-year qualitative analysis was merged with general chemistry and a short course in organic was given. The combination of qualitative and inorganic eliminates considerable waste of time which is often involved in the laboratory work of general chemistry. Organic chemistry received sufficient attention to satisfy the most partisan, and physical chemistry was apparently orthodox, it being too early in the history of chemical engineering to expect an industrial view of it or any application to industrial problems. Quantitative analysis and organic chemistry are actually overbalanced. It is unnecessary to give as much attention to them. They can hardly be called harmful, yet it is a case of the law of diminishing returns beginning to operate.



ABOVE—The George Gilbert Pond Laboratory for quantitative analysis and physical chemistry.

RIGHT—The main chemical laboratory at Penn State.

Industrial chemistry completed the list of courses in chemistry. Somewhat arbitrarily this has been listed as a chemistry course rather than as a chemical engineering study. This is because its content was largely chemical and descriptive, rather than technological. It has been changed now to Chemical Engineering, as it should with the changing problems of industry.

In those days the engineering studies were given a different emphasis from that which they receive today, especially electrical engineering. This was, as we see it now, unwise, for heat engineering was relatively neglected and there can be no question as to the relative importance of these two fields to the chemical engineer. Descriptive geometry—the somewhat unnecessary mental gymnastics of engineering education—is included. The extra emphasis of electrical engineering has already received comment. The shop work was too completely identified with wood working, the manual dexterity gained being a little unnecessary for the chemical engineer, and the specific knowledge not particularly useful. Yet the unfavorable criticism is just about over. Mechanical drawing, mechanics, flow of fluids and materials testing are, all of them, vital. "More heat!" we might be tempted to cry, as fuels, furnaces and thermodynamics do not receive much attention.

The two courses listed as Chemical Engineering are unusual. The first might be considered as a course in pure chemistry, but it wasn't (and isn't, for it is still a part of the curriculum). It actually supplies some of the missing heat engineering already mentioned. It includes the technical analysis of gases and the thermochemistry of combustion. Applied electrochemistry was a course designed to focus for the industrial chemists a considerable part of the special technology developed by the course in electrochemical engineering. A comment might be made to the effect that specialized courses are dangerous. They should be neither numerous nor emphasized in any general curriculum.

There is no doubt that the curriculum was too heavy. In the days when it was being developed the basic idea seemed to be to fill the student full to bursting and hope that the mental digestive system would stand the strain. Happily we have begun to learn our lesson and to realize it is not so much the capacity to cram that counts as the capacity to digest. It is therefore not a serious criticism to say that Professor Pond's course was too heavy. That was the product of the period. But heavy or not, the course produced results and that was because of the personality. Chemical engineering has developed enormously since Professor Pond's death, and it will continue to grow. There may come a time when his course will be a curiosity, but that will be after his students have ceased to exert a significant influence in the chemical engineering industries, and it is a long way off. He will stand always as one of the creators of chemical engineering education and as one of the progressive educators of his time.

Absorption of Nitrogen Oxides in the Chamber Acid Process

The Relation of the Principal Variables of Temperature, Purity and Concentration of Sulphuric Acid to Absorptive Efficiency

By George E. Beavers
Superintendent Acid Department, Tennessee Copper Co.

SULPHUR DIOXIDE is unable to absorb an additional atom of oxygen without the aid of some third substance that can act as a carrier of oxygen. The material employed for this purpose in chamber sulphuric acid plants is one of the nitrogen oxides that is capable of adding oxygen to sulphur dioxide, and of again taking up oxygen from the air. Thus, nitrogen peroxide, NO_2, by the loss of one atom of oxygen, is reduced to nitric oxide, NO, that in its turn combines with atmospheric oxygen and is reconverted into nitrogen peroxide.

If no loss of nitrogen peroxide took place during the cycle, the same quantity of this gas would convert an infinite amount of sulphur dioxide and water into sulphuric acid; but in practice, owing to gas leakage, defective absorption and the reduction of part of this compound to nitrous oxide, it is necessary constantly to replenish that portion of the nitre supply that is lost.

This is usually done by generating a small quantity of nitric acid in retorts or pots that are placed in or near the flue between the pyrites burner and the Glover tower. From this nitric acid "niter fumes" or oxides of nitrogen, are evolved, by means of heat applied to the pots. The sulphur dioxide, nitrogen oxides from the pots and the excess air from the pyrites burner all proceed to the Glover tower, entering near the bottom and leaving near the top. The Glover tower is made of lead and is lined with acid-proof brick. The tower filling is broken quartz or staggered brick. Its function is fourfold: (1) To cool the hot burner gases before they enter the lead chambers, (2) to serve as an intensive acid production medium, (3) to concentrate the chamber acid and (4) to denitrate the nitrous vitriol acid. The acid from the Glover tower either runs to storage for finished material or is pumped to the tops of the Gay-Lussac towers to produce more of the nitrous vitriol acid.

The gases from the Glover tower proceed through a series of large lead chambers, where, with the aid of water introduced as a fine mist, the remainder of the sulphur dioxide is converted into sulphuric acid and the nitrogen oxides then pass up through the Gay-Lussac towers to be absorbed by the acid discharged from the Glover tower, with which the Gay-Lussac towers are fed. The nitrous vitriol acid from these towers is pumped to the Glover tower to be denitrated.

In many sulphuric acid plants there is either a heat shortage, or else full advantage is not taken of the available heat in the Glover tower, and consequently the concentration of the acid from the Glover to the

A Modern Chamber Process Plant
Sulphuric acid plant of the Tennessee Copper Co. at Copperhill, Tenn. Note the relation of plant layout to the surrounding natural topography.

Table I—Effect of Specific Gravity of Acid on Absorption

Test No.	Temperature of Acid in Meyer Bulbs Deg. F.	Vol. of Acid Each Bulb Series C. C.	Vol. of Gas Aspirated, Liters	Oz. of Nitrogen Oxides Absorbed per Cu.Ft. of Acid, Calc. to Sodium Nitrate — Deg. Bé — 57	60	66
1	88	100	120	16.9	18.5	19.3
2	84	100	120	21.7	22.6	23.6
3	86	100	120	22.4	23.9	24.7
4	86	100	120	20.9	22.8	22.6
5	84	100	120	27.1	28.0	28.3
6	81	100	120	29.3	31.3	33.0
7	82	100	120	28.3	30.4	31.3
8	83	100	120	26.6	29.4	31.3
Ave. of tests 1 to 8 inclusive				24.2	25.9	26.8

Gay-Lussac tower is not adequate for the most efficient absorption of the nitrogen oxides from the chambers. Often the impurities from the sulphur burners enter the Glover tower and mix with the acid, causing the H_2SO_4 content of the acid to be lower than the specific gravity would indicate. Again, ample cooling of the gas mixture proceeding from the chambers to the Gay-Lussac towers, and also of the acid being circulated through the Gay-Lussac towers, is sometimes neglected.

The effect of the dilution of sulphuric acid on the recovery of nitrogen oxides has been stated by Lunge ("Sulphuric Acid and Alkali," Vol. I) as follows: "Nitrosyl sulphuric (nitrous vitriol) acid is unstable in the cold, in sulphuric acid containing approximately 64 per cent H_2SO_4." Consequently, the acid used for absorption must be much more concentrated than this, if efficient results are to be obtained. On the other hand, the tendency of the solution to solidification is a limiting factor, as the sulphuric acid becomes highly concentrated. For sulphuric acid containing 90 per cent H_2SO_4, the limiting concentration is approximately 10 per cent HNO_3 and 4 per cent HNO_2. Any further passage of nitrous gases into the solution causes the separation of nitrosyl sulphuric acid and the formation of a pasty solution that is difficult to handle.

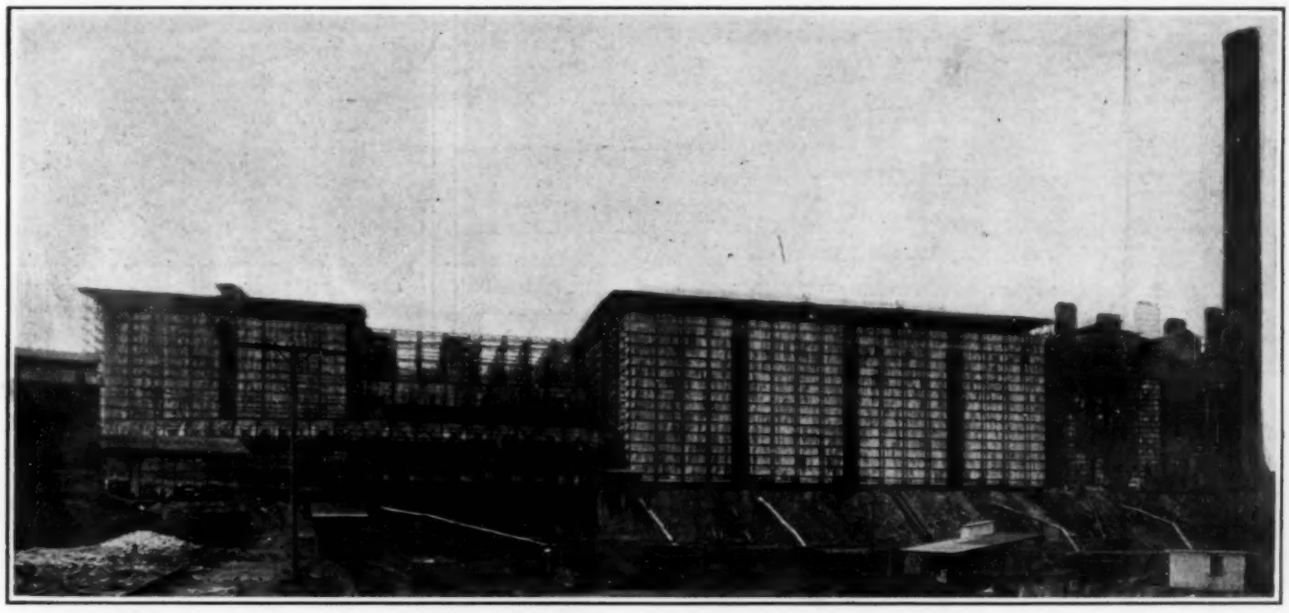
In order to investigate the influence of the specific gravity, the purity and the temperature of sulphuric acid on the capacity for absorbing oxides of nitrogen, a number of tests were made, the results being shown in the accompanying tables. All tests were made by aspirating gas drawn from the flue connecting the final chamber of an operating acid plant with the first Gay-Lussac tower through sulphuric acid solution contained in Meyer bulb tubes. It is recognized that these tests were not broad in scope, but the results are published at this time to show their trend, which is quite definite. For reasons that will appear below, these tests were divided into three groups.

In Group I the temperature of the acid, purity of the acid, volume of acid and volume of chamber exit gas aspirated were substantially constant, but tests were made with different concentrations of acid, varying from 57 to 66 deg. Bé. The purpose of the tests of this group was to determine the influence of the specific gravity of the acid solution on absorption.

In Group II the temperature, specific gravity and volume of acid and volume of gas aspirated were kept constant, but the percentage of impurities (solids in suspension or in solution) in the acid was varied. The purpose of the tests of this group was to determine the effect of impurities in the acid on absorption.

In Group III the volume, purity and specific gravity of the acid and the volume of gas aspirated were kept constant, but the temperature of the acid was varied. The object of the tests of this group was to determine the influence of temperature of the acid on absorption.

Sixty-six deg. Bé. acid cannot be used economically in Gay-Lussac towers because of its cost, but taking 60 deg. Bé. acid as standard, then 57 deg. Bé. acid is only 93.4 per cent as efficient as 60 deg. Bé. acid in the absorption of nitrogen oxides.



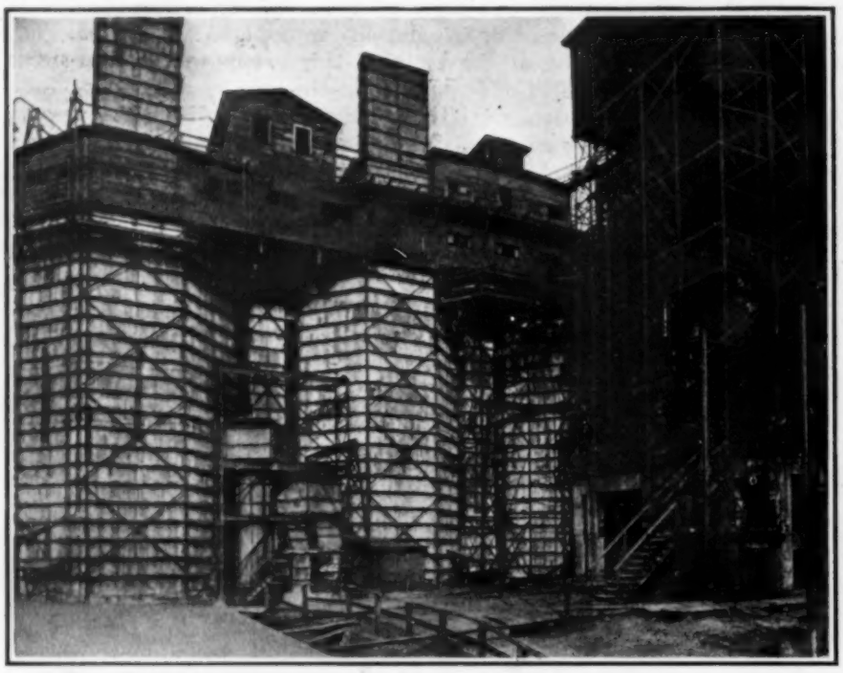
A Good View of the Chambers

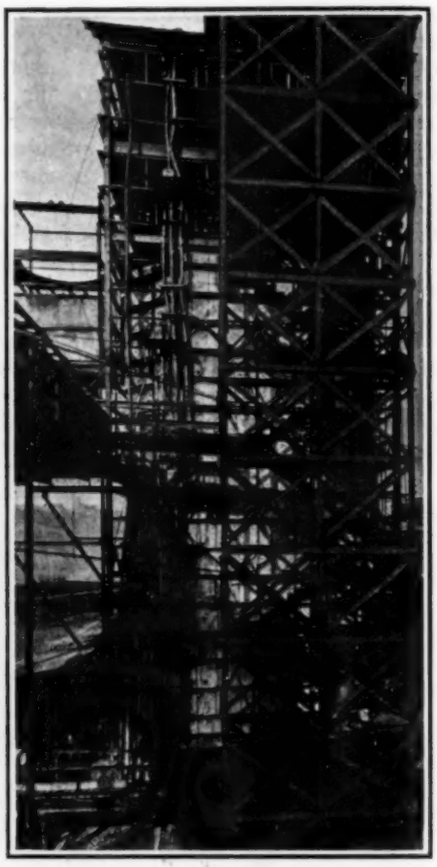
Part of the No. 1 sulphuric acid plant of the Tennessee Copper Co. The Glover tower is on the extreme right.

Table II—Effect of Impurities on Absorption

Temp. of Absorbing Acid, Deg. F.	Vol. of Absorbing Acid, C. C.	Vol. of Gas Aspirated, Liters	Oz. of Nitrogen Oxides Absorbed Calc. to Sodium Nitrate per Cu.Ft. of Acid	Gravity of Acid at 60 Deg. F., Deg. Bé.	Per Cent H_2SO_4	Oz. of Solids per Cu.Ft. of Acid
			Test No. 1			
			8.24		73.96	3.11
76	100	40	8.76	58	74.30	0.29
			8.47		72.50	16.00
			Test No. 2			
			20.7		73.96	3.11
75	100	120	21.7	58	74.30	0.29
			19.7		72.50	16.00
			Test No. 3			
			21.8		73.96	3.11
83	100	120	22.6	58	74.30	0.29
			21.3		72.50	16.00
			Test No. 4			
			22.2		73.96	3.11
87	100	120	24.7	58	74.30	0.29
			22.2		72.50	16.00

RIGHT—Gay-Lussac Tower—Here is where the absorption of nitrogen oxides takes place for recirculation.
BELOW—Glover Tower—Perhaps the most interesting and sensitive part of a chamber process plant. Its function is described fully in the text of this article.





The average niter recovery of the acid, with 0.29 oz. of foreign matter, is 19.44 oz.; with 3.11 oz. of foreign matter, 18.23 oz., and with 16.0 oz. of foreign matter, 17.92 oz. Taking 19.44 oz. recovery as standard, the efficiency of the acid with 3.11 oz. of foreign matter is 93.8 per cent and of the acid with 16 oz. foreign matter is 92.2 per cent.

Table III—Effect of Temperature on Absorption

Temp. of Acid in the Bulbs, Deg. F.	Vol. of Acid, C. C.	Vol. of Gas Aspirated at S. C.	Oz. of Nitrogen Oxides Absorbed Calc. to Sodium Nitrate per Cu.Ft.
	Test No. 1—Acid of 77.67 per Cent H_2SO_4		
78			25.9
75	100	74.65	25.9
160			25.1
	Test No. 2—Acid of 77.67 per Cent H_2SO_4		
65			23.0
65	100	76.56	22.9
150			22.0
	Test No. 3—Acid of 77.67 per Cent H_2SO_4		
80		79.38	25.8
100		75.76	24.4
120	100	75.76	24.0
150		75.76	23.7
	Test No. 4—Acid of 77.67 per Cent H_2SO_4		
80		76.40	24.0
96	100	76.40	24.0
126		76.20	23.4
160		76.20	23.2

The average recovery in the tests with acid from 65 to 80 deg. F. was 24.6 oz.; from 96 to 126 deg. F. 24.1 oz. and from 150 to 160 deg. F. 23.5 oz. Using the coolest acid as standard, the acid from 96 to 126 deg. F. is 98 per cent efficient, and the acid from 150 to 160 deg. F. is 95.6 per cent efficient.

At the sulphuric acid plant where these experiments were made, a loss of 1 per cent of the nitrogen oxides, based on the total in circulation, represents a loss of $59.15 per 1,000 tons of 60 deg. Bé. acid made. This figure was calculated in the following way: Each 1,000 tons of 60 deg. Bé. acid made contains 253.6 tons of sulphur. With a consumption of nitrate of soda of 4 per cent, based on the sulphur in the acid made, there is a loss of 10.14 tons sodium nitrate per 1,000 tons of acid made. The average recovery of nitrogen oxides at this plant, based on total niter in circulation, is 88 per cent; hence there is a niter loss, based on total niter in circulation, of 12 per cent. The cost of nitrate of soda in retorts was assumed to be $70 per ton.

Progress on Benzol Poisoning

The second progress report of the subcommittee on benzol of the committee on industrial poisons, National Safety Council, is now available. Research has been in progress for more than 2 years, and definite recommendations as to the use of this important solvent have been outlined by the committee, of which Prof. C. E. A. Winslow of Yale University is chairman.

Recent studies have confirmed the prevous view of the committee that benzol poisoning is a very real industrial hazard. Investigations have disclosed a series of fifteen deaths and eighty-three more or less serious illnesses occurring as a result of industrial benzol poisoning during the past few years.

Out of a group of eighty-four workers exposed practically continuously to benzol vapor of varying concentration, 15 per cent showed a white blood cell count so low as to be strikingly suggestive of chronic poisoning, indicating that besides the obvious clinical cases there exists in industry a considerable amount of mild undetected poisoning of this type.

By the use of the charcoal absorption method, the amount of benzol and of other solvent vapors in the workroom can be determined with a precision sufficient for practical purposes.

Cleaning Cans With Electricity

A Simple Electrolytic Cell Salvages Paint Buckets Cheaply and Efficiently

A PROBLEM common to many plants that produce materials such as paint and varnish, pulp colors, lakes, dye pastes, and printing and lithographic inks is that of salvaging used buckets, tubs and other metal containers. Hand scrubbing or washing in hot lye and other cleansing solutions is not always practical on account of labor costs, and further more in some instances it is physically impossible to remove contaminating materials without damaging the container.

At the plant of the Mountain Varnish & Color Works, Toledo, Ohio, an ingenious solution for the problem of

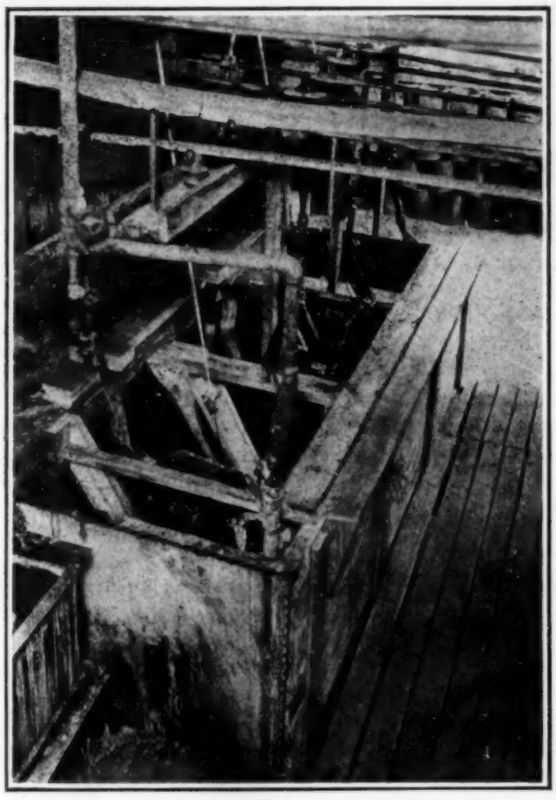


Fig. 1—Electrolytic Bath for Dirty Paint Cans
The paint buckets are attached to suitable electrodes and submerged into the solution of electrolyte contained in this tank. After the current has been on for 5 minutes the old paint loosens and drops off to leave the clean surface.

cleaning used paint buckets has been worked out by the simple application of the electrolytic process, using standard equipment and apparatus easily constructed in the plant. Figs. 1 and 2 show the electrolytic cell in which the paint buckets are cleaned. Fig. 3 is a 5,000-ampere Jantz & Leist motor-generator set used to produce the current, which is transmitted at from 8 to 12 volts, through 1¼-in. copper bars leading to the cleaning tank. A number of different electrolytes can be used in the solution, although the composition of the mixture naturally depends somewhat upon the character of the material to be removed from the container. By means of steam coils the electrolyte is heated to a temperature of 160 to 180 deg. F.

At the Toledo plant the process is used for cleaning ordinary iron paint buckets, open at one end, 12 in. in

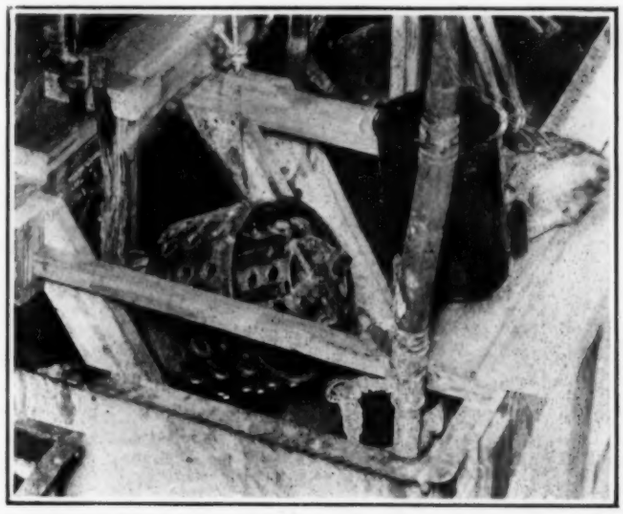


Fig. 2—Electrode Raised to Receive Bucket
The construction of the anode and method of attaching the buckets may be clearly seen from this view.

diameter and 13 in. high. A clamp carrying the negative pole is fastened to the bottom of the bucket, and the positive pole is then inserted. The latter, as may be noted in Fig. 2, is an insulated cage constructed to cover the inside of the container, yet allowing a space of about 2½ in. between the metal and the anode. After the buckets have been placed on the rack it is lowered into the solution and remains submerged for about 5 minutes with current on, taking about 1,000 amperes at 12 volts. The action of the current is to form a gas under the paint which lifts it from the metal. The latter does not mix to any great extent with the electrolyte and after a few days running the removed paint can be taken out of the tank, leaving the electrolyte solution ready for re-use.

The process can be operated on a continuous basis requiring the services of one or at the most two men to clean forty-eight buckets per hour. Cost figures are not available for all operations at the Toledo plant, but in so far as the current is concerned, the cleaning process requires 12 kw. for 5 minutes at an average

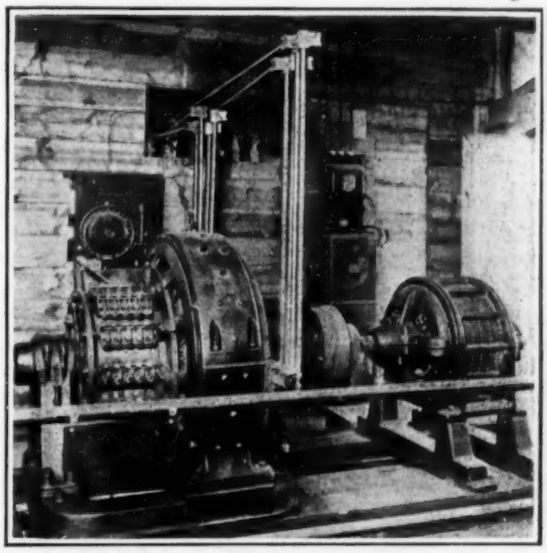


Fig. 3—The Motor Generator Set That Supplies the Current
A 5,000-ampere generator that delivers its current at voltage which may be adjusted from 8 to 12 volts.

Fig. 4—Raw Material and Finished Product
Marked improvement in the appearance of the bucket at right is the result of the electrolytic cleaning

cost of 2 cents per kw.-hr. Hence twelve buckets per hour could be cleaned at a cost of 2 cents per bucket for current. Since four buckets are cleaned at a time, the output per hour is forty-eight buckets. Formerly it required five or six men to do the same work by hand scrubbing and the buckets are now returned in much better condition. In fact, as may be seen in Fig. 4, they have practically the same appearance as a new container. It is also significant that the process avoids the use of any flammable solvent and the buckets come from the electrolytic bath with the paint completely removed. This is to be contrasted with the use of hot lye solution that only softens the paint, which must then be wiped off with a rag or otherwise removed.

Future Sources of Potash and Ammonia

Bureau of Soils Survey of the Economic and Technologic Aspects of American Sources of These Important Fertilizer Materials

By J. W. Turrentine
In Charge, Potash Investigations, Bureau of Soils

SURVEYS of the nation's resources in potash show that vast quantities of that essential commodity are available from two general classes of raw materials, those yielded as waste products of present industry and those represented by natural deposits of potash salines and minerals. For example, surveys of the cement, the blast furnace and the distilling industries, now completed, show an annual waste of potash that is approximately equal to our present importation from European countries. Furthermore, the amount potentially available from that perennial source, the kelps of the Pacific coast, and from the saline deposits of the West, and the minerals, such as the alunites of Utah, the greensands of New Jersey, the leucites of Wyoming, and the shales of Georgia, are practically unlimited and inexhaustible. The technology of extracting potash from these sources is being studied with a view so to cheapening the processes of extraction that the potash industry may be established on a much broader basis.

Byproduct Recovery Essential

In the potash investigations conducted by the Bureau of Soils, special emphasis is being placed on byproduct recovery, as it is realized that only by the simultaneous extraction of other compounds can the production of potash from present known sources be accomplished profitably. Recent developments appear to justify the belief that the potash now going to waste in the major industries will be saved and made available for agriculture, and that the major silicates, particularly greensand, will soon become a commercial source of production.

In the potash minerals, alumina is a common and important constituent as illustrated by alunite, leucite, greensand, sericite and feldspar. Economical recovery of potash depends on the simultaneous recovery of the alumina at least and any other possible byproducts. Potash and alumina as joint products from silicates lend promise to natural sources long since discarded as probable sources of potash alone. Each assists the other in sharing production costs. It is confidently predicted that the future will witness an intimate economic relation between these two essential raw materials of industry, potash for fertilizers, and alumina for metallurgical uses. Throughout the investigations attention is accorded consideration that potash in the future should be yielded in a form that makes its combination with concentrated fertilizer both convenient and economical. Thus it should be yielded as phosphate or nitrate or in some form readily convertible into them, as carbonate or hydrate.

Coal Largest Source of Ammonia

To increase the nation's supply of agricultural ammonia the activities most certain to yield results of importance are those directed toward the increased conservation of ammonia contained in bituminous coal, and the development of an American nitrogen fixation industry. The conservation of the ammonia of coal can be promoted by the complete abandonment of the beehive oven with a simultaneous development of byproduct coking through the increased use of gas and coke for domestic and industrial heating as a substitute for raw bituminous coal. The possible gains are far reaching. Not only would vast quantities of ammonia be recovered, but in addition, there would be other byproducts of value such as benzol for motor fuel. An abatement of the smoke nuisance and all that that represents in the destruction of property and public welfare would follow. What is here advocated is already being realized and its rapid solution will be determined by the promptness with which the public accepts the substitution of coke for raw bituminous coal.

Nitrogen Fixation Uncertain

On the other hand, the nitrogen fixation industry for the production of agricultural ammonia is yet to be established in this country. Processes are already developed to a point where the industry is entirely warranted and these are being further improved in a most capable and efficient manner by the Fixed Nitrogen Research Laboratory of this department.

There are also various minor sources of ammoniates, principally of organic origin, that in the aggregate are important; these are found among trade wastes and as byproducts of farm operations. These problems are being subjected to laboratory investigation by G. B. Walton, and are yielding valuable results. New sources of organic ammoniates are being sought and efforts are being made to develop present sources through improved technology.

A Research Laboratory With a Human Product

Training Men for Industrial Scientific Research Is the Primary Function of the Research Laboratory of Applied Chemistry of the Massachusetts Institute of Technology

By Chaplin Tyler
Of the Editorial Staff of *Chem. & Met.*

SIXTEEN years ago, Dr. William H. Walker conceived the idea of a college laboratory of applied chemistry that would serve adequately the needs of the student and the general public, as well as the industrial enterprise. Dr. Walker's splendid vision has been realized. Young men are being trained in applied science by actual experience; a broad program of research of general interest is being carried on; a consulting and research service has been established; and lastly, a new standard of professional ethics for colleges, whereby the interests of the private consultant are protected, has been set. Following a brief historical sketch and a description of the laboratory equipment and personnel, is a detailed account of its functions, method of operation and business policy.

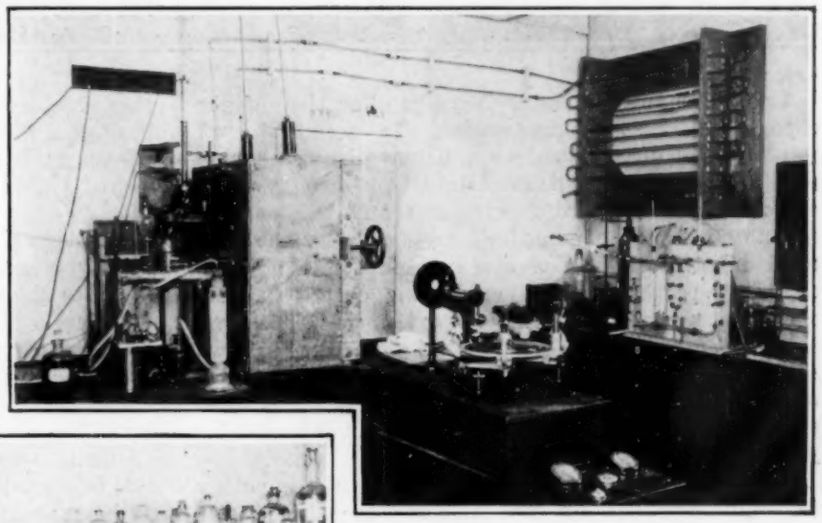
The Research Laboratory of Applied Chemistry of the Massachusetts Institute of Technology was created in 1909, to fill a comparatively small but urgent demand of a few industries for counsel in applied chemistry and chemical engineering. Dr. Walker, at that time professor of chemical engineering, was the first director of the laboratory.

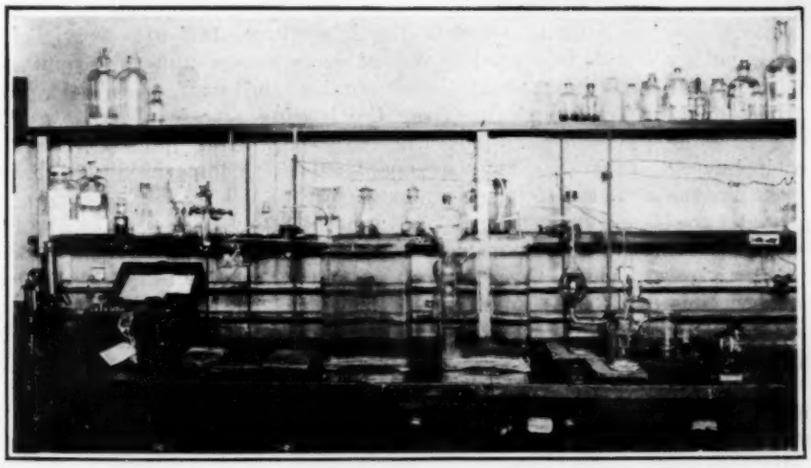
During the early part of the laboratory's growth, from 1909 to the time of the war, its personnel consisted of several members of the regular teaching staff, who gave part of their time to research problems. Among the contributions of this first period were basic researches on the corrosion of iron and steel, the corrosion of galvanized iron and tin-plate, and an economic study of the electrolysis of salt solutions. Shortly after the entrance of the United States into the war, the members of the laboratory went into the government service, Dr. Walker being assigned to Edgewood Arsenal as commanding officer.

In 1919, after 2 years of interruption, the laboratory was reorganized on a much larger basis, and for the past 6 years it has had a personnel of about twenty full-time research men, all of whom are qualified for independent investigations in some major branch of chemical technology.

X-Ray Laboratory

On the right is a corner of the modern, fully equipped X-ray laboratory. A Coolidge tube having a water-cooled radiator supplies the radiation for the gas ionization and other experimental work. In the foreground is a precision X-ray spectrometer, the most accurate of its kind in existence.



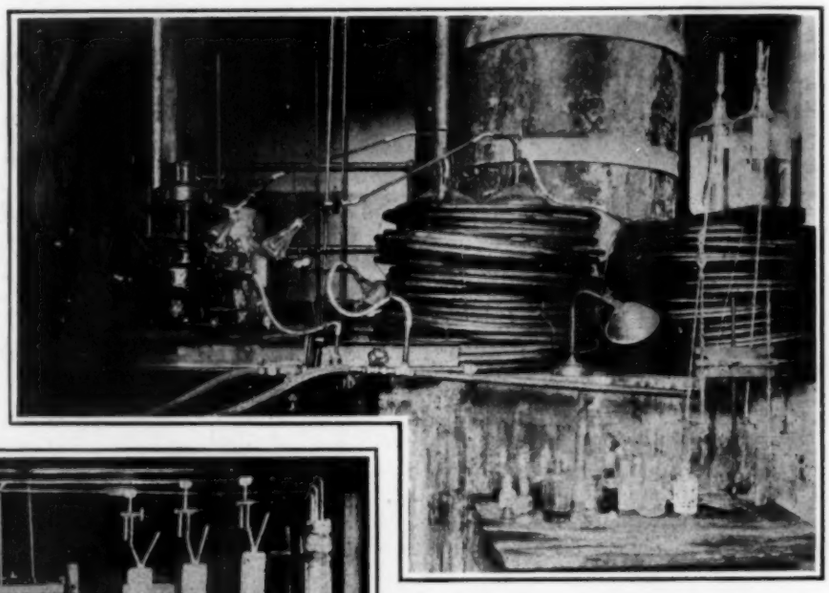


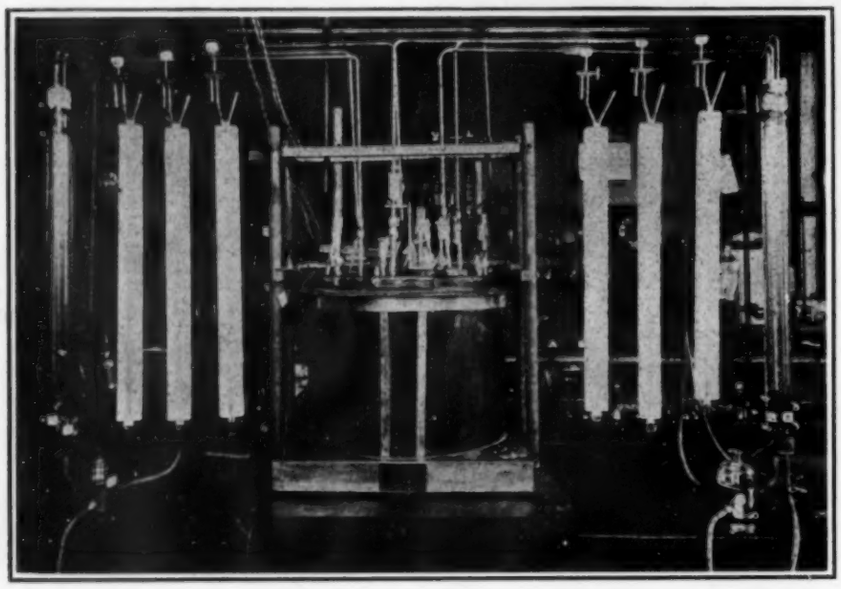
Studies on Electrodeposition

To the left is an apparatus for the quantitative study of the effect of colloids on cathodic metal deposition. Zinc and nickel have been chosen, as the deposition of these metals has assumed great commercial importance in the last decade. This is a typical "public service research" problem.

Natural Water Corrosion

Right — Study of the corrosion of steel pipe by natural water, using the "oxygen drop" method.





Oxidation of Rubber

Left — Measuring the rate of oxidation of rubber films at constant temperature and pressure.

The laboratory is under the administration of the chemical engineering department. Its technical staff consists of a director and an assistant director having professorial rank, and from fifteen to twenty research associates and assistants. Five or six of the research associates have the immediate responsibility of technical direction. These men are specialists in physical chemistry, colloid chemistry, organic chemistry, and chemical engineering. Their supervision is functional in plan. In addition to the technical staff, there are two secretaries, a purchasing agent, a mechanic, a draftsman and a messenger. In order to give uninterrupted service, the laboratory operates throughout the calendar year.

The laboratory is situated in the main Technology Building, and has for its exclusive use three office rooms, one conference room, two large laboratories, seven small laboratories, two storerooms and a machine shop. Division into small laboratories, each having space for from one to three men, makes possible the segregation of problems of a like nature, and experience has shown that this arrangement is satisfactory. In addition to the usual laboratory equipment, there are special apparatus such as an ultra-microscope, colorimeter, complete X-ray machine, 5-kw. motor-generator set, ultra-violet lamp, potentiometer, gasoline engine, electric furnace, gas furnace, constant temperature baths, corrosion testers, a bearing-testing machine and a polishing machine. The extensive equipment of the other Technology laboratories, particularly those of chemical, mechanical and electrical engineering, is available for testing or other special work.

Training Men for Research

The primary function of the laboratory is the training of young men for scientific research. Even research service to industry is subordinated to this main purpose, and therein lies the fundamental difference between this laboratory and organizations such as the industrial research laboratory and the private consultant. A glance at the following outline of functions should make this difference clear:

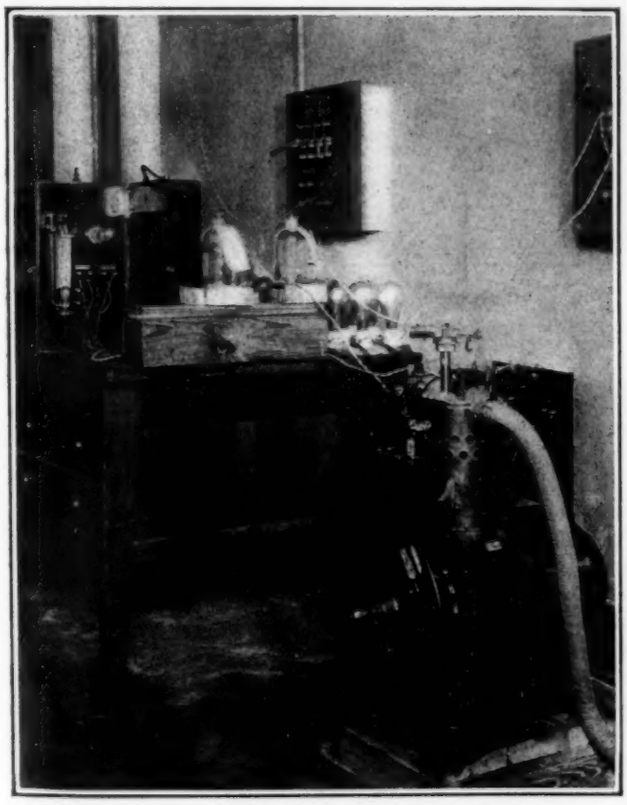
Appointments to the laboratory staff are restricted to a few graduates that have shown unusual promise in their professional studies and experience. These men are drawn from the leading schools at home and abroad, and for the most part they have advanced degrees. They are paid salaries comparable to those of the other members of the M.I.T. staff, and are encouraged to devote approximately one-tenth of their time to advanced study. After a period of from 1 to 5 years, they usually leave the laboratory to fill positions of importance in research, development or production. The major product of the laboratory is, therefore, men thoroughly trained in applied science.

The physical surroundings and method of direction are very nearly ideal from the standpoint of training. In the first place, the equipment of the laboratory is

modern, efficient and inclusive. Special apparatus is designed and then constructed under the direction of the reasearch man himself. Excellent libraries are available, and the proper use of handbooks and a familiarity with the contemporary scientific periodical literature is gained. By means of frequent conferences and progress reports the research man is encouraged to develop his ability for written and spoken expression, to marshal his ideas and to show initiative. In brief, an effort is made to train the staff in the methods of efficient, scientific research.

Instruction in Advanced Subjects. The laboratory offers exceptional advantages to the student electing his thesis in the field of applied chemistry. He receives from members of the laboratory staff the firm but sympathetic instruction needed by the inexperienced investigator. The senior members of the staff give specialized graduate courses such as the sub-atomic chemistry of matter, colloid chemistry, rubber, petroleum, lubrication, corrosion and combustion. Because of their contact with industrial problems, they are well fitted for such work and they form, in effect, a supplementary teaching staff.

Research Service to Industry. Second in importance to education for research is the professional service rendered to industry. The research laboratory was perhaps the first college laboratory to offer technical counsel of high grade at reasonable cost, and at the same time with full regard for the rights of private consultants. An old and unfortunately well-founded complaint of private consultants is the unfair competition of college professors. Whether or not college professors as individuals should be allowed to carry on a consulting practice is not the important issue; in fact it is probably highly desirable that they be accorded this means of augmenting their usually meager salaries and of keeping actively in touch with the problems of industry. However, the business methods of this type of consultants should be controlled to a certain extent by their respective institutions. The specific objection of the private consultant is the frequent underbidding by college professors, who have at their disposal not only free office, library and laboratory space, but very often the services of assistants at a nominal expense, as well. Unquestionably such a procedure constitutes unfair competition, and it is largely up to institutions to regulate the fees charged by faculty members to such an extent that a condition of unfair competition ceases to exist. Then, too, there is the college professor who, as between teaching and consulting, lets his teaching suffer; this is clearly to the loss of the employing institution.



Anti-Knock Research
Delco engine equipped with Midgley knock indicator for anti-knock fuel studies

The plan of the research laboratory offers one way out of this difficulty. Its staff members receive a fixed salary and devote full time to the interests of the organization. The fees charged are on a par with those of competent private consultants, with the result that the laboratory not only is self-supporting, but is enabled with the accumulated surplus to finance an extensive program of public service research.

From the standpoint of industry, and even of the private consultant, a well-organized institutional laboratory, such as the research laboratory, fills several distinct needs, aside from its regular functions. In the first place, a laboratory with strong resources in staff and equipment is particularly well prepared to handle certain problems that require either a variety of professional talent or an unusually large amount of physical equipment. Such a problem is rarely profitable to the private consultant. Second, there is the problem of fundamental nature, the results of which are doubtful of outcome and often discouraging. Because of the high educational value, the institutional laboratory often prefers such a problem.

A minor but important function of the laboratory is the recommendation of young men for positions in research, development or operating capacities. Quite often members of the staff are recommended for such places; but in any event, the man is one whose qualifications are thoroughly known. Any large corporation will testify to the difficulty of picking men for responsible positions, and in acting in this capacity the laboratory does a real service to the man and to the future employer.

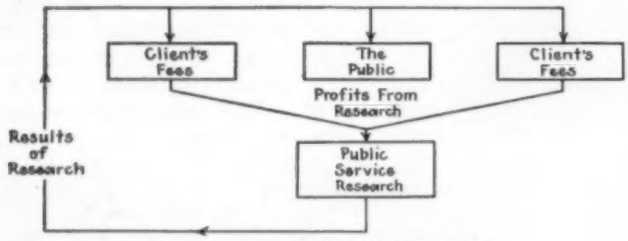
Public Service Research. The laboratory's policy of charging fair competitive fees makes possible the accumulation of a substantial surplus that is used almost entirely to finance research of general public interest. The results of such research are made public in appropriate technical journals, and these contributions are reprinted also for distribution to the public upon request. The exact relation of public service research to industry is shown by the diagram herewith.

The laboratory's program of public service research is expanding steadily, both in scope and in the total amount of work done. During the past 5 years, attention has been focused on the corrosion of iron and steel, the combustion of fuels, the mechanism of lubrication, the flow of heat, the flow of fluids and the mechanism of catalysis, with special reference to oxidation reactions.

More specifically, an outline of the investigations so far conducted includes:

Corrosion of Iron and Steel. Fundamental factors in the natural water corrosion of iron and steel; the effect of velocity on acid corrosion; corrosion in various salt solutions; the corrosion of copper-steels; the rôle of ferrous hydroxide in corrosion; atmospheric corrosion; and the development of standard corrosion test apparatus.

Combustion. A study of gas producer reactions; the



Financing Public Service Research

Profits from paid research make an extensive program of general investigation possible

efficiency of powdered coal furnaces; heat balance in blast furnace stoves.

Mechanism of Lubrication. Static coefficients of friction between various metallic and glass surfaces, using various liquid lubricants; a study of the property of "oiliness"; a study of journal-bearing lubrication with special reference to friction as a function of viscosity, surface speed, and bearing pressure; and the design and construction of a bearing testing, and a wear testing machine.

Flow of Heat. A study of coefficients of heat transmission through films, especially those of boiling liquids, and of condensing steam.

Flow of Fluids. The development of a general relation for the flow of fluids through pipes, expressing friction as a function of density, pipe diameter, velocity and viscosity.

Catalysis. The rôle of catalysts in the oxidation of hydrocarbons.

Of particular interest to those in industry is the mechanism by which the laboratory serves its clients; how the research is planned, executed and finally put to actual use. Problems may be grouped into three classes: First, major problems in development requiring several months to as many years for completion, as for example, the development of a new process for the manufacture of gas black; second, major problems in research in a new application or of a fundamental nature, such as a study into the causes and prevention of the corrosion of steel pipe; and third, minor problems involving little or no original experimental work. Problems of the first and second types are desired particularly by the university laboratory on account of their high educational value, length of duration and because of the possibility of obtaining publishable results. However, minor problems are often the means of establishing more extensive relations with a client.

The first step in the solution of a problem is a conference at which the object of the research is stated clearly, and a tentative means of attack is decided upon. The client signs a contract that specifies performance at a given rate of compensation and over a certain calendar time. Results and inventions are assigned without reservation to the client. The client is also given an estimate of the cost of the research and of the time required to attain a specified stage of progress. Such an estimate is, however, so dependent upon subsequent developments in the course of the investigation that it means little except as an aid in budgeting. Suppose, for example, that a client wishes to utilize waste sodium sulphate, and suggests electrolysis of the solution to make caustic soda. At the initial conference the director of the laboratory will explain that although the process is not a commercial one, it has possibilities sufficient to warrant development. A tentative schedule will then be drawn, something like this:

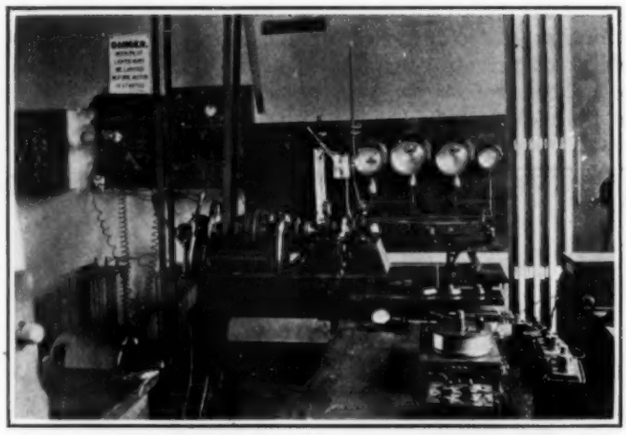
For survey of the literature, and a determination of the necessary physical constants of sodium sulphate solutions, such as specific gravity versus concentration, electric conductance versus concentration, and electric conductance versus temperature, 4 weeks.

For the construction of an experimental electrolytic cell, and a short investigation of anode materials, based on sodium chloride practice, 2 weeks.

For experimental runs on the cell, with a view to determining the faults in design, 1 week.

For the construction of an improved electrolytic cell, and for extensive runs to determine the optimum concentration of brine, temperature and rate of feed, and current density, 8 weeks.

For a study of the commercially practicable materials



Studying the Mechanism of Lubrication

A full-bearing testing machine with temperature, load, and oil pressure control

of construction, and specifications of design, and final experimental runs, 6 weeks.

For final report, 1 week.

Total estimated time, 5 months.

Although an estimated schedule of this sort is not in any sense exact, the client is almost certain of knowing definitely at the end of 6 months whether or not the investigation should be continued. At the end of that time, should further development seem advisable, a second schedule would be made, and so on. Such a schedule, together with bi-monthly progress reports, and frequent conferences or correspondence with the client keeps a definite goal always in view, and has been very satisfactory in practice.

Additional service to the client includes assistance in the preparation of patent applications, a reasonable proportion of consultation with the directors of the laboratory, and assistance in placing technical men in clients' permanent organization.

Readers' Views and Comments

An Open Forum

The editors invite discussion of articles and editorials or other topics of interest

Cost of Refractories From Georgia Kaolins

To the Editor of Chem. & Met.:

Sir—On page 1004 of your issue of Dec. 29 under the caption "Common Sense and Common Refractories," the author states:

"In the southeastern states, deposits of kaolin are found that are about as free from impurities as could be desired as far as refractoriness is concerned, the fusion point being about cone 35, or near the maximum limit for clays. This material is being used to some extent in refractories, but it has the disadvantage of being difficult to shrink completely on account of its high degree of purity and its fluffy nature. In one case it is being thoroughly calcined and then made into brick, but at such an expense that the product sells for $250 per thousand."

Necessarily this refers to the kaolins of Georgia and South Carolina, as these are the only deposits of importance in the southeastern states.

I have had considerable experience in research and manufacture of refractories from Georgia clays and I hope you will allow space to correct the erroneous statements as to the difficulties and cost of calcining the material and manufacturing brick.

There are four distinct types of secondary kaolins in Georgia which are decidedly different in their physical properties. Their deformation or softening temperatures vary from cones 33 to 35.* These four types have been classified as follows: 1. Flint. 2. Hard. 3. Semi-hard. 4. Soft.†

The flint variety so far has been found only in the vicinity of Gibson, Glascock County, Georgia. The clay does not slake and has no appreciable plasticity. This clay is mined and shipped to Birmingham, Ala., where it is used in the manufacture of firebrick.

The hard and semi-hard clays slake and filter press with more or less difficulty. They are hard, tough, dense and show good bonding strength. They are extremely plastic, mold with ease and dry and burn without cracking, though their shrinkage is comparatively high.

The soft kaolins slake readily and filter press with ease and are washed for the filler and, to a more limited degree, the ceramic trade. When dried, the soft clays are friable, low in bonding strength, tend to crack in drying and are, perhaps, what has been referred to as "fluffy."

There are two plants at the present time making firebrick from hard and semi-hard Georgia clays. One plant is located in Baldwin County, and the other in Hancock County. Three different grades of firebrick are made. The first-grade brick deform at cones 34 to 35 and are sold f.o.b. cars at $38 to $42 per thousand, which is, of course, considerably less than $250 per thousand.

The hard and semi-hard kaolins are very abundant and widely distributed, whereas the soft clays are comparatively scarce. It has been conservatively estimated that there is enough hard and semi-hard clay in Wilkinson County, Georgia, to make all the clay firebrick and other clay refractories for more than 600 years at the present rate of consumption.

Aside from their use in the two refractory plants above mentioned, the hard and semi-hard clays are practically unknown in the Northern markets, whereas the soft crude and washed clays (the fluffy variety) have been sold in the Northern markets for years. Therefore it is natural that those unacquainted with the different varieties would picture the soft, friable variety when Georgia kaolin is mentioned.

The flint, hard and semi-hard varieties are most excellent and practical for the manufacture of refractory products, whereas the soft variety is not so suitable, although it is practical to make refractories from such clay. If the product of even the soft variety will sell for $250 a thousand, a veritable gold mine awaits the prospective manufacturer.

It is not necessary to calcine the clay for grog above a temperature of cone 14 unless one wishes to make "super" refractories. A modern refractories plant of large capacity, equipped with a rotary (cement type) kiln for calcining and a car tunnel kiln for burning, can manufacture firebrick from Georgia kaolin at a total cost not to exceed $25 per thousand.

The advantages of the rotary calcining kiln lie in the fact that it can be operated at any desired temperature from cone 14 up to cone 26. The advantages of the car tunnel kiln have been set forth many times in ceramic literature. The waste heat can be used advantageously for drying and the calcining would not add in excess of $9 or $10 per thousand to the production cost.

The present price of labor in the clay district is 17½ to 20 cents per hour, fuel oil 5½ cents per gallon and coal $4 per ton. The kaolins occur in massive beds, many of which are more than 40 ft. in thickness. These clays can be stripped and mined with power shovel and hauled to the plant at a cost not to exceed 40 cents per ton.

R. T. STULL.

Savannah, Ga.

To the Editor of Chem. & Met.:

Sir—Mr. Stull's criticism of that part of my article "Common Sense and Common Refractories" which concerns kaolins deals almost entirely with the cost of manufacturing into refractories and the difficulty of calcining. High refractoriness is granted in the original article, although the softening temperature of cone 33 to 35 which Mr. Stull gives is somewhat in excess of that given for the flinty kaolins in an article published by him and to which he refers.

It will also be granted for the sake of argument that firebrick can be manufactured from these clays for $25 per thousand. However, we do not believe that brick made at this cost would be satisfactorily constant in volume for some of our industrial furnaces. Data given in an article* of which Mr. Stull is a co-author sub-

*"Refractory Possibilities of Some Georgia Clays," *Journal American Ceramic Society*, vol. 6, No. 6, p. 665, May, 1923.

†"Distribution of Kaolin and Bauxite of the Coastal Plain of Georgia," *Journal American Ceramic Society*, vol. 7, No. 7, pp. 511-518, July, 1924.

*"Refractory Possibilities of Some Georgia Clays," G. A. Bole and R. T. Stull, *J. Am. Ceram. Soc.*, vol. 6, p. 665 (1923).

stantiate this belief. In this, the porosity and burning shrinkage of several kaolins and bauxite clays are given. At cone 11 these kaolins had an average linear burning shrinkage of 16.3 per cent and an average porosity of 30.1 per cent. Anyone familiar with the testing of fireclay will agree that both of these values are excessive. The shrinkage corresponds to 2 in. in a foot and the high remaining porosity indicates a high residual shrinkage. When these kaolins were made into brick and burned at cone 14, the product averaged 33.5 per cent in porosity. No shrinkage figures were given. One clay was selected as being typical of a number of deposits and brick made from 60 per cent calcined at cone 14 and 40 per cent raw clay. These were fired at cone 14 with a linear burning shrinkage of 2.75 per cent and a burned porosity of 34.0 per cent. The fact that the standard sized brick were only 6½ lb. in weight would in itself indicate a lack of density.

As the information shown above was obtained by Mr. Stull in an investigation for the purpose of exploiting these clays, it must be assumed that the samples were at least representative of the materials commercially obtainable.

There are also other data available corroborating the contention that the kaolins are difficult to shrink completely. It is true, as previously stated, that one concern is incorporating a high content of kaolin in its product, and is going to a very great expense to calcine it and properly burn the brick. In spite of this, and its fusion point of cone 35, some tests have shown that at a temperature of 3,000 deg. F. the shrinkage was excessive as compared with some products of lower refractoriness, but greater density.

In the criticism it is stated that "It is not necessary to calcine the clay for grog above a temperature of cone 14, unless one wishes to make super-refractories." It is assumed from this that higher calcining temperatures would admittedly produce a much greater shrinkage, else the product would differ little from the regular output and would not deserve the name "super-refractory." Cone 14 in commercial burning practice corresponds to about 2,425 deg. F., this maximum temperature being maintained for only a few hours. If higher calcining would increase the shrinkage to a marked extent, it appears obvious that it would also take place in furnaces operated at temperatures above 2,425 deg. F.

Mr. Stull refers to the use of rotary kilns for calcining clays for refractories, giving the advantages and the cost of operation. A complete description of one of these kilns which is being operated in this way would be most acceptable to the refractories industry. A recent inquiry among ninety manufacturers of refractories failed to disclose a single kiln of this type being used.

M. C. BOOZE,
Senior Fellow,
Refractories Manufacturers Association Fellowship.
Mellon Institute,
Pittsburgh, Pa.

Utilizing Exhaust Steam in an Evaporator

To the Editor of Chem. & Met.:

Sir—The article "Electric Power as a Byproduct of Process Steam Generation" in your Jan. 5 issue, p. 5, brings to mind an interesting utilization of exhaust steam introduced about 25 years ago at the smelting plant of the Compania Metalurgica Mexicana, San Luis Potosi, Mexico, by Robert S. Towne, president of the company.

Oak wood was used for fuel, but before burning the bark was removed, ground and leached to produce tanning extract. Instead of using live steam to evaporate this extract, Mr. Towne suggested that the exhaust from the two compound Corliss engines be used, thus making the evaporator function as condenser. This arrangement was found to give a vacuum of 12 to 15 lb. at the low-pressure cylinders.

This use of exhaust steam had the further advantage of preventing destructive overheating of the extract, particularly near the completion of evaporation, a point in the operation which requires careful attention by the operator when live steam is used. It was my observation, however, that the operator quite generally used some live steam just at the end of the evaporation.

An indirect benefit was the elimination of scale in the boilers, as the result of small amounts of tannin finding their way into the boiler feed. The spent tan bark was dried and burned under the boilers in specially designed fireboxes.

R. C. CANBY.
Wallingford, Conn.

Developments During 1924 in the Naval Stores Industry

To the Editor of Chem. & Met.:

Sir—In your Jan. 19, 1925, issue, p. 89, J. C. Nash, vice-president of Columbia Naval Stores Co., Savannah, Ga., has given a review of the naval stores industry as it applies to marketing and marketing conditions. His survey and figures are accurate. Inasmuch as the reference to the production, which is a very important part of the naval stores industry, is contained in the last sentences of the article, it is felt that this has been rather meager and for this reason I should like to supplement his statements.

Among important developments pertaining to production that have taken place in the year 1924 is a recognition on the part of the naval stores operators of the importance of temperature control in the production of spirits of turpentine and rosin. While this idea was introduced several years back, it has never received the attention it deserved until the past year. The result has been an increased yield of spirits of turpentine from given quantities of crude turpentine as well as improved grade or grades of rosin. This improvement of methods has come about through the efforts of government agencies. It has received recognition elsewhere and for that matter it should be noted in your publication.

Another important improvement has taken place in the matter of conservation of forests. While this work was begun years ago by Dr. Herty, it has received greater impetus in the past year than it has for numbers of years. The Forest Service is responsible for this regard for conservation by the naval stores operators. The particular feature that has been stressed in the past year and that has been bearing results is what is known as light scarification or chipping of the pine trees. This has cared for the tree in that it has allowed the tree to continue to grow and it has also shown the operator that he may at the same time care for his tree as well as to obtain yields from it. Longer time operations are possible for the carrying out of

these suggestions. This is a forward step in conservation and should be noted as part of the progress of the naval stores industry for the year 1924.

THOMAS GAMBLE,
Savannah, Ga. Editor, *Naval Stores Review.*

Something for Nothing

To the Editor of Chem. & Met.:

Sir—The writer is interested in your editorial "Something for Nothing" (Dec. 15, p. 917) and agrees with the sentiments expressed therein to the fullest extent. However, we can call your attention to the fact that the same tactics in many cases are pursued the other way around.

There are equipment manufacturers and "engineers" who profit by the confidential installation of machinery and contact with employees of industrial plants to the extent of using or even patenting the knowledge so obtained. NATURAL PRODUCTS REFINING CO.,
H. A. GOMAN,
Jersey City, N. J. President.

Heywood Not Co-Author With Toulmin

To the Editor of Chem. & Met.:

Sir—On looking over my letter which accompanied the article by H. A. Toulmin, Jr., appearing in the Jan. 26 issue of your magazine, I can see why you erroneously assumed that it should be jointly signed, although the manuscript was not signed with my name.

I am not a patent attorney. My connection with the article was solely as an adviser to Mr. Toulmin as to what editorial treatment such an article should have to make it attractive to a trade magazine, and to attend to the details of placing it.

If you could find some way to straighten out this error in the minds of your readers, both Mr. Toulmin and myself would appreciate it. JOHNSON HEYWOOD.
Yonkers, N. Y.

Continuous Enamel Spraying

To the Editor of Chem. & Met.:

Sir—In your Editorial Staff Review of Technical Progress of the Year, page 104, Jan. 19, 1925, issue, you mention the continuous enamel spraying system as one of the principal developments of the ceramic industry. There, you are behind the times. I invented the machine for this work in 1913, one being used at St. Louis and one at Winslow, N. J.

Three million face brick used in the Equitable Building, New York, 11 years ago went through these machines, and a few millions each year since have gone to some of the largest building operations in the country.

I feel it a privilege to criticise you and a pleasure to praise you for the high standard of your writings on ceramics. S. H. IVERY,
Hydraulic-Press Brick Co., St. Louis, Mo. Superintendent, Enamel Plant.

EDITOR'S NOTE: The new development specifically referred to in our Jan. 19 issue was the continuous spraying of sheet iron and sheet steel ware. While the cases are not quite identical, owing to the greater complexity of shapes in enamelware, it is most interesting to find that the enameled face brick industry developed a successful system at such an early date.

Phosphoric Acid As an Industrial Chemical Reagent

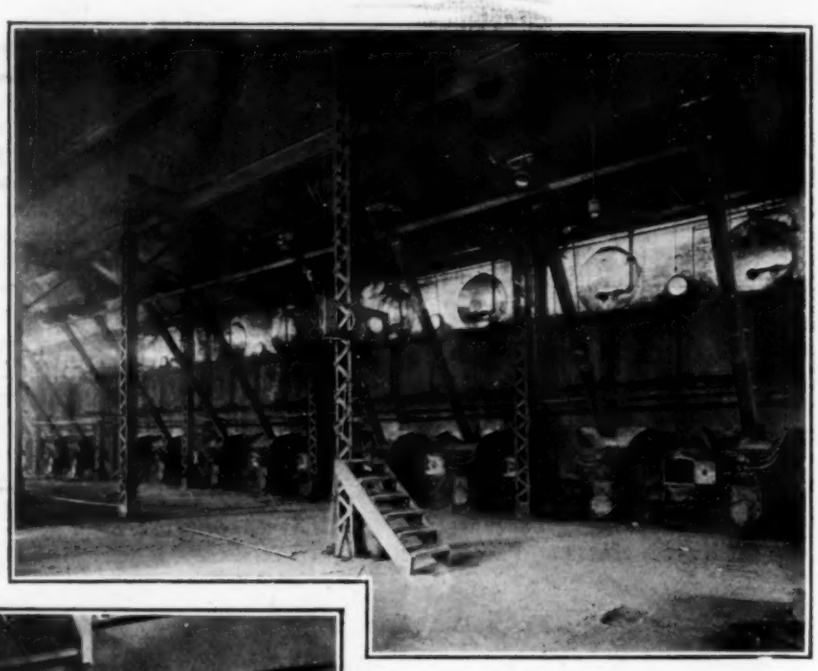
To the Editor of Chem. & Met.:

Sir—The present trend of the fertilizer industry toward the manufacture and use of concentrated fertilizers makes phosphoric acid the key material. Under present practice and for many years past, that essential element of plant food has constituted the greater part of mixed fertilizers. The phosphoric acid investigations of the Bureau of Soils were designed primarily to decrease waste at the phosphate mines that used inefficient methods of concentration. There are instances where this waste is equivalent to 50 per cent of the theoretical yield. High transportation costs and the requirements of the export trade in phosphate rock will make necessary the concentration of the rock to the highest practicable degree.

Methods have been developed by this bureau whereby the run-of-mine rock may be treated for the volatilization of its phosphoric acid. At first, the electric furnace was employed; this was replaced by a fuel-fired furnace, and recently J. D. Jacob found that a temperature as low as 1,300 deg. C. could be used, provided proper conditions are maintained. In fact two methods have already been adopted and put into commercial application by large industrial concerns. Phosphoric acid of 80 to 100 per cent concentration is already being produced when formerly it entered the market as 15 per cent concentration. The cost of manufacture of a high-grade product at the present stage of development compares favorably with that in the manufacture of low-grade acidified phosphate rock.

Emphasis should be placed on the potential value of phosphoric acid to agriculture through its use as an industrial chemical reagent as a possible substitute for sulphuric and other acids in those applications where soluble phosphates useful for fertilizer may be yielded as a byproduct. For example, hydrochloric acid could be made by substituting potassium chloride for the sodium salt and thus obtain a residue containing both potash and phosphoric acid—that is, potassium phosphate. In the recovery of ammonia in the byproduct coking of coal, sulphuric acid is employed with a production of ammonium sulphate that contains 24 per cent plant food. If phosphoric acid be substituted (which is apparently possible without change of apparatus or operation), ammonium phosphate containing 76 per cent plant food is produced. Sulphuric acid makes no contribution in this instance to the rated fertilizer value of the products, and its use, therefore, represents an expense for which there is slight recompense. On the other hand, if phosphoric acid be substituted, the increased value of the products offsets the cost of the acid. The absorption of synthetic ammonia in phosphoric acid offers economies not possessed by any other method of fixing that compound.

America exports both phosphates and ammonia, the former as concentrated phosphate rock containing 36 per cent phosphorus pentoxide, and the latter as ammonium sulphate, containing 24 per cent of ammonia gas. We are the only nation that exports both of these commodities. If the two were combined as ammonium phosphate, a product containing 76 per cent of available fertilizer would result. J. W. TURRENTINE,
In Charge, Potash Investigations, Bureau of Soils.
Washington, D. C.



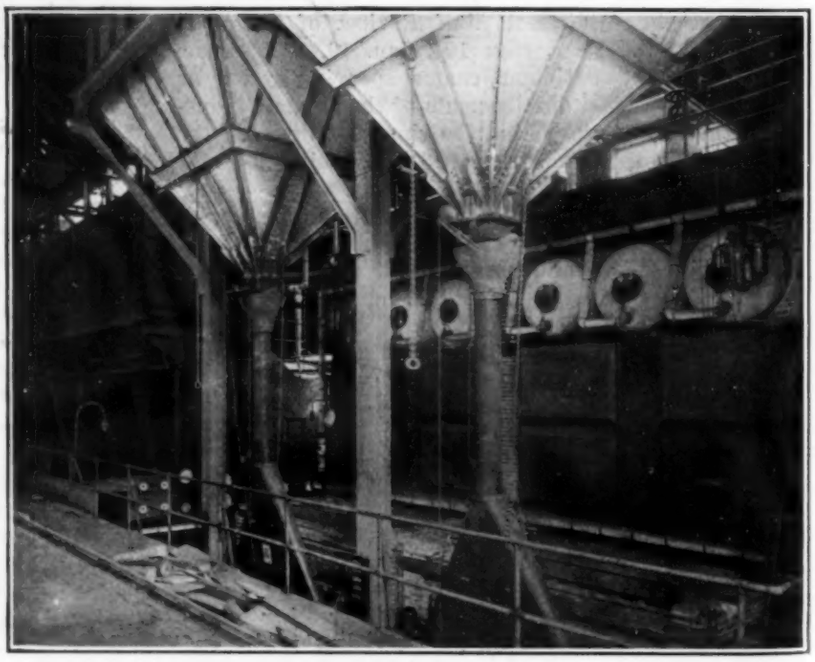
Right — This large cement plant has equipped its boiler room with stokers and a modern coal-handling system. Provision has also been made for a future increase in capacity of 100 per cent, as will be noted from the unoccupied bay in the foreground and the outlets for future connections to the coal bunker.

Steam Generation: An Important Process

THE economical generation of steam is one of the most important requisites for success in the process industries, entering, as it does, into the cost of operation from two angles, those of power cost and of heat cost. This fact should have won as much attention for the boiler room of the industrial plant as is lavished on the central station boiler plant. Unfortunately, industrial executives have not in the past paid much attention to the economy of this department, and it is only the occasional plant, such as those illustrated on this page, in which the boiler room approaches modern central station practice.

Above—The boiler room of this sugar refinery is another example of modern coal-handling equipment and stokers applied to the boiler room of a process industry. This type of equipment can often be applied to an existing installations of hand-tended boilers at a cost that shows an overall saving.

Right—This plant, in which insulating material and refractory insulation are made, has applied stoking and coal-handling equipment to both the older boilers on the left and the recent installation on the right. The numerous control instruments shown in this view indicate a just appreciation of the value of boiler room economy.



Equipment News

From Maker and User

Protective Covering

The metallic lead paint, "Subox," described in *Chem. & Met.*, Nov. 17, 1924, page 775, can now be obtained in the United States, a sales office under the name of Subox, Inc., having been installed at 874 Broadway, New York.

Briefly, this paint consists of a colloidal suspension of metallic lead in boiled linseed oil, which after a proper period of hardening protects surfaces upon which it is spread from corrosion, electrolytic decomposition, and rotting to an extent, it is claimed, that surpasses other protective coatings.

Gas Producer

Rotary grate pressure gas producers developed by the U.G.I. Contracting Co., Philadelphia, Pa., for use in supplying fuel to coal gas retorts have now been made available for general industrial purposes. These producers are designed to operate with fuel having a large percentage of breeze without a material reduction in capacity or efficiency.

The fuel is charged into the top of the producer from a hopper on a revolving water-sealed table. The space around the upper gas outlet cell is always kept full of fuel. This space contains about 2 hours supply. In charging by this method the large lumps of fuel tend to segregate and flow toward the middle of the producer and the breeze sifts down the sides. This distribution of fuel gives the best operating condition with a mixed fuel of this nature.

A water jacket and steam drum is provided on the lower part of the producer, which serves to generate sufficient steam for the producer blast. Primary air is blown under pressure into the producer. The water seal is sufficient to allow a pressure of from 16 to 20 in. of water under the grate, although from 10 to 12 in. is usually sufficient for normal operation. In cases where a cold, clean producer gas is desired, the gases passing out of the producer are led through a waste-heat boiler and a further supply of steam is obtained in this manner.

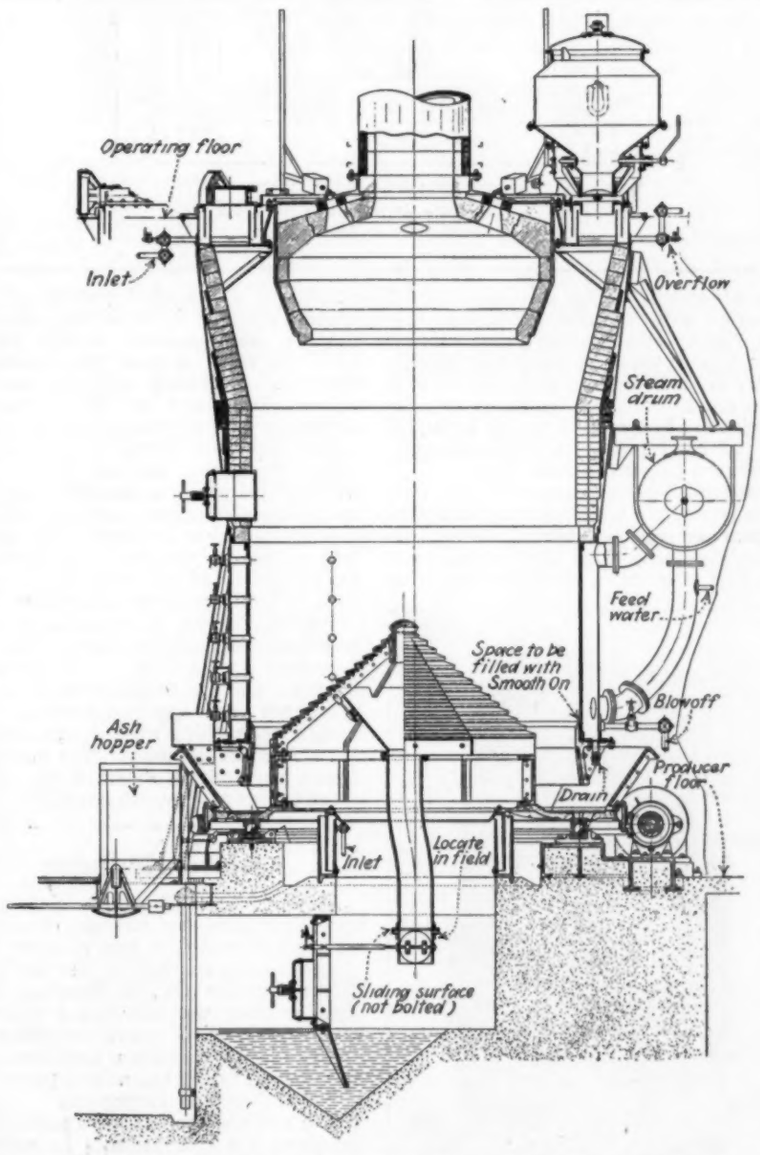
Fuels containing up to 30 per cent ash are easily handled with this producer. With a fuel of 20 per cent ash containing a mixture of half and half breeze and small coke, the producer is claimed to deliver 88 per cent of the heat content of the fuel in the form of hot gas.

The producers are available in two sizes—an 8 ft. 6 in. internal diameter producer with a normal capacity of 25 tons per hour of a 50 per cent mixture of breeze and small coke, and a 10 ft. 6 in. internal diameter producer with a normal capacity of 35 tons per 24 hours of 50 per cent mixture breeze and small coke. When small coke only is fed to these producers, their capacity is respectively 30 and 40 tons per 24 hour day.

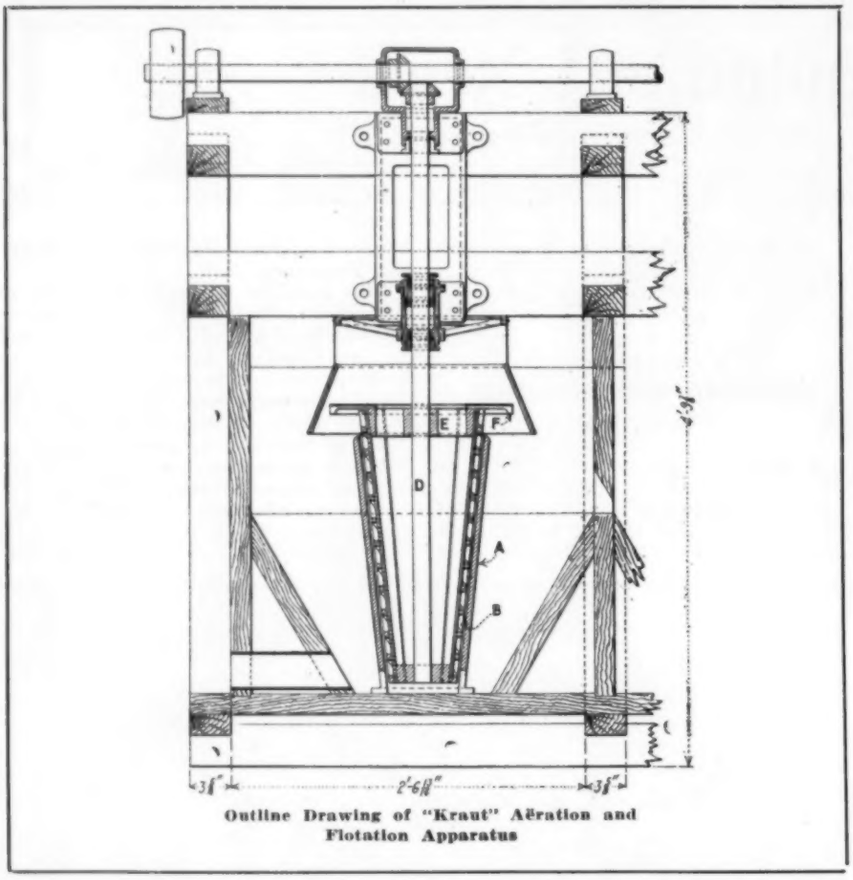
Aëration and Flotation Machine

A novel machine for aërating or oxidizing a fluid or carrying out the process of flotation has been invented by M. Kraut and is now being made and marketed by the Bunting Iron Works Co., First National Bank Bldg., San Francisco, Calif.

This machine is shown in outline in the accompanying cut. It consists essentially of a small box, characterized by depth rather than by breadth or length, in which is placed a container (*A*), with ports near the bottom (*B*) for the entry of solution or pulp, the depth of which in the unit, or series of units, is maintained according to the level of the overflow. Inside the stationary container revolves, at 800 r.p.m., the aërating member, of molded, hard rubber, or other material, the sur-



Outline Section of the U.G.I. Rotary Grate Pressure Gas Producer, Showing the Eccentric, Cone-Shaped Pier Grate, Water Seals, Fuel Inlet and Other Features of This Design

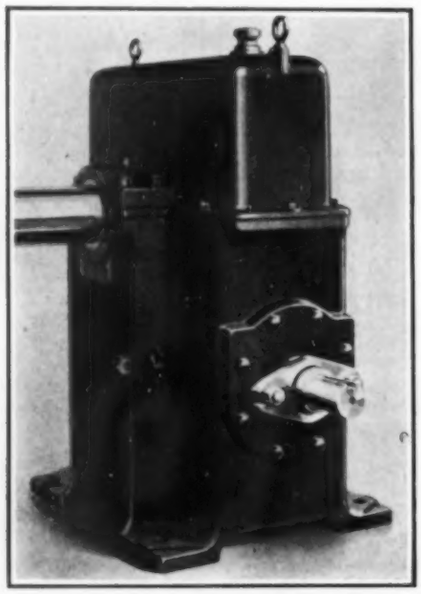


Outline Drawing of "Kraut" Aëration and Flotation Apparatus

face of which, facing the container, is provided with a series of helices, between and behind which eight vertical slots are provided to allow the passage of air from the space *D*, in which it is maintained at slight pressure by the provision of vanes (*E*). A baffle, *F*, also of hard rubber, deflects the pulp downward below the pulp level.

The machine operates on the continuous principle. Feed passes to the bottom of the apparatus, being deflected by false sides toward the entry *B*. The effective part of the revolving member is submerged, and its circular motion tends to force or suck the solution or pulp upward in the narrow space between it and the stationary member. Clearance with the standard machine is about ¼ in. With enlarging diameter, the peripheral speed of the rotary member increases in regular ratio, from the bottom to the top, thereby insuring a definite and progressively effective suction of air through the channel ports, this suction being aided by the pressure caused by the movement of the vanes *E*.

Each unit is provided with two froth overflows, for use if flotation is being practiced, at opposite sides. The surface area provided is 5 sq.ft. per unit. Capacity for ore flotation work can be calculated on the assumption that ¼ sq.ft. of frothing area is required per ton of ore per 24 hours. The power required per unit is about ¾ hp. Floor space covered is unusually small.



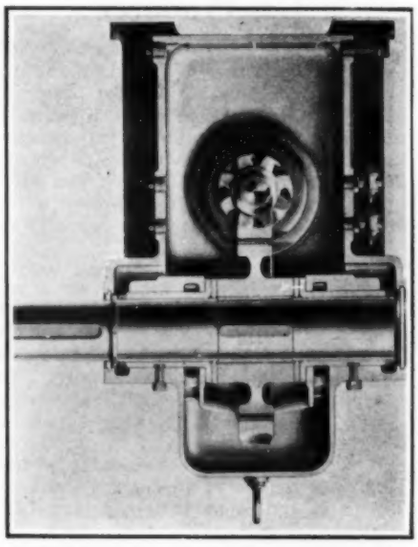
Worm and Wheel Speed Reducer With Casing Assembled

Speed Reducer

A new type of worm and wheel speed reducer for use in direct-connected motor drives has recently been placed on the market by the De Laval Steam Turbine Co., of Trenton, N. J. This reducer was developed with the needs in view of such machinery as rotary kilns and coolers, agitators, mixers, driers, mills, calenders, paper machinery, fans and conveyors.

The tooth shape has been particularly designed for this reducer in order to combine a minimum of sliding action with a maximum of rotary action between the worm and the wheel, and at the same time to obtain the greatest continuous area of contact. Undercutting of the teeth is entirely avoided, as the included angle of the tooth is approximately 60 deg., as compared with about 30 deg. in many other tooth shapes. As the pressure line normal to the face of the tooth at the pitch circle falls within the base of the tooth, failure can take place only by crushing and not by bending. The gears are designed so that three or more teeth are always in contact, giving an exceptionally high load capacity for size and weight.

The reducer is completely inclosed in a casing that is dust and moisture proof. This casing is split horizontally in the plane of the center line of the wheel shaft. A large oil reservoir with baffles on the bottom serves to settle all foreign matter from the oil. The wheel shaft is carried in plain bronze bearings of the split type. The worm can be mounted either above or below the wheel as desired and is carried on ball bearings, that at the rear of the worm being of the combined radial and thrust type, while that at the forward end is of the radial type. The worms are made from alloy steel forgings,



Section Through Speed Reducer, Showing Design of Worm, Wheel, Oiling Devices, etc.

while the wheels are made from phosphor bronze. In this way a low coefficient of friction is attained.

These reducers are made for ratios of 4 to 1 up to 100 to 1 in one step. For higher reductions there are reducers with double reduction. Power is delivered at right angles to the motor setting, so that motors can be set out of the way and machinery can be arranged in a closer alignment. Frames for vertical drive are also supplied if desired.

Manufacturers' Latest Publications

A. F. Craig & Co., Ltd., Paisley, Scotland—A leaflet describing the "Moore-Burmah" oil cooler for chilling paraffin.

Sullivan Machinery Co., 122 South Michigan Ave., Chicago, Ill.—Bulletin 76-E. A new bulletin describing electric portable hoists of the single and double drum types.

American Blower Co., Detroit, Mich. — Bulletin 1218. A catalog describing the "Venturafin" unit heater for factory heating.

U. S. Patents Issued Feb. 3, 1925

Emulsifying Process and Multistage Emulsifier. Cyrus Howard Hapgood, Nutley, N. J., assignor to the DeLaval Separator Co., New York, N. Y.—1,524,651.

Process of Waterproofing and Waterproofed Material. Donald M. Liddell, Elizabeth, N. J.—1,524,663.

Building Material and Process of Manufacturing Same. Donald M. Liddell, Elizabeth, N. J.—1,524,664.

Compound for Addition to Motor Fuel and the Fuel Resulting From Such Addition. Samuel S. Sadtler, Springfield Township, Montgomery Co., Pa., assignor to Charles C. Benton, Philadelphia, Pa.—1,524,674.

Fireproofing and Insulating Composition and Process of Making the Same. Edward R. Stowell, Portland, Ind., assignor of one-half to Charles M. Mayo, Indianapolis, Ind.—1,524,676.

Decolorizing Substance. Wolf Kritchevsky, Chicago, Ill., assignor to William Citron, trustee, Chicago, Ill.—1,524,737.

Preparation for Bread Making. Rolland Curtner, Marion, Ind., assignor to Rumford Chemical Works, Providence, R. I.—1,524,783.

Process for the Distillation of Solid Fuel. Remo De Bartolomeis and Romolo De Bartolomeis, Milan, Italy, assignors to Societa Anonima Forni Ed Impianti Industriali, Milan, Italy.—1,524,784.

Basic Dye. Walter Konig, Dresden, Germany, assignor to Farbenfabriken vorm. Friedr. Bayer & Co., Leverkusen, near Cologne on the Rhine, Germany.—1,524,791.

Installation for Expressing Material in Cage Presses. Emil Alois Adam, Utrecht, Netherlands, assignor to Utrechtsche Machinefabrik Opgericht door Frans Smulders, Utrecht, Netherlands.—1,524,803.

Apparatus for Treating Hydrocarbon Oils. Gustav Egloff and Harry P. Benner, Independence, Kan., assignors to Universal Oil Products Co., Chicago, Ill.—1,524,818.

Process of Preparing Fullers Earth. Charles C. Ruprecht, Olmsted, Ill.—1,524,843.

Mixing Apparatus. Frank A. Browne, Wayne, Pa., assignor to the Barber Asphalt Co., Philadelphia, Pa.—1,524,854.

Gilsonitic Products. Charles N. Forrest, Rahway, Harold P. Hayden, Raritan Township, Middlesex Co., N. J., and Orin R. Douthett, Beaver Falls, Pa., assignors to the Barber Asphalt Co., Philadelphia, Pa.—1,524,859.

Grinding Mill. Povl T. Lindhard, Brooklyn, N. Y., assignor to F. L. Smidth & Co., New York, N. Y.—1,524,871.

Printing Ink. Earl H. McLeod and Walter W. Mock, Rutherford, N. J.—1,524,872.

Composition for Printing Inks for Transfers. Trowbridge Marston, Morristown, N. J., and Ira F. B. Hutton, Woodhaven, N. Y., assignors to Kaumagraph Co., New York, N. Y.—1,524,874.

Molding Machine. Charles Ladd Norton, Boston, Mass., assignor to Refractories Machinery Mfg. Co., Pittsburgh, Pa.—1,524,877.

Insecticide. Ruric C. Roark, Baltimore, Md.—1,524,882, 1,524,883 and 1,524,884.

Apparatus for Forming Blocks or Bricks or Plastic Material. George C. Debay, Springdale, Pa.—1,524,915.

Filtering Process and Apparatus Therefor. Rod A. Demme, New York, N. Y., assignor, by mesne assignments, to Darco Corp., Wilmington, Del.—1,524,916.

Process for the Manufacture of Malonic Acid Esters. Jean Altwegg and Charles Maillard, Lyon, France, assignors to Société Chimique des Usines du Rhone, Paris, France.—1,524,962.

Apparatus for the Production of High-Nitrogen-Content Cyanamide Granules. Gaston Lefort des Ylouses, Paris, France, assignor to La Société l'Azote Français, Paris, France.—1,524,968.

Phenolic Resin and Process of Making the Same. Clarence A. Nash, Chicago, Ill., assignor to Bakelite Corp., New York, N. Y.—1,524,995.

Composition of Matter for Use as a Wax. Artiode Sellari, Brownsville, Tenn., Carl Trippi, Willisville, Ill., and Ted Martin, Brownsville, Tenn., assignors to Sellari Mfg. Co., Brownsville, Tenn.—1,525,001.

Method of Manufacturing Lubricating Oils. James W. Weir, Fillmore, Calif.—1,525,016.

Machine for Soaking Substances in Liquids. Eli H. Allen, Melrose Highlands, Mass.—1,525,018.

Process of Making Aluminum Chloride. Charles E. Parsons, New York, N. Y., and Samuel Peacock, Wheeling, W. Va., assignors to Metal Research Corp., New York, N. Y.—1,525,041 and 1,525,042.

Alloy and Method for Producing Same. Charles J. Rath, Alliance, Ohio, assignor to Non-Corrosive Metal Co., Oklahoma City, Okla.—1,525,047.

Mixed-Pulp Product and Process of Making the Same. William H. Savery, Wilmington, Del.—1,525,050.

Gas Expander-Absorber. John C. Bertsch, Tulsa, Okla.—1,525,060.

Mercury Derivatives of Hydroxy-Benzoic Acids. Walter Kropp, Elberfeld, Germany, assignor to Farbenfabriken vorm. Friedr. Bayer & Co., Leverkusen, near Cologne-on-the-Rhine, Germany.—1,525,078.

Halogenated Isoviolanthrene and Process of Making the Same. Robert G. Caswell, and Ellsworth G. Marshall, Wilmington, Del., assignors to E. I. du Pont de Nemours & Co., Wilmington, Del.—1,525,117.

These patents have been selected from the latest available issue of the "Official Gazette" of the United States Patent Office because they appear to have pertinent interest for "Chem. & Met." readers.

Complete specifications of any United States patent may be obtained by remitting 10c. to the Commissioner of Patents, Washington, D. C.

Apparatus for Handling Glass Sheets. John H. Fox, Pittsburgh, Pa., assignor to Pittsburgh Plate Glass Co.—1,525,124.

Tunnel Kiln. Winfield E. Hinsdale, Trenton, N. J.—1,525,130.

Process of Drying Articles. Halbert K. Hitchcock, Pittsburgh, Pa., assignor to Pittsburgh Plate Glass Co.—1,525,131.

Leer for Annealing Sheet Glass. Halbert K. Hitchcock, Pittsburgh, Pa., assignor of one-half to Hitchcock Experiment Co., N. J.—1,525,132.

Saveall. Ernst W. Kopke, Manila, P. I.—1,525,136.

Removal of Hydrogen Sulphide From Gas. Matthew D. Mann, Jr., Roselle, and Robert B. Lebo, Elizabeth, N. J., assignors to Standard Development Co., Delaware.—1,525,140.

Machine for Forming Articles From Paper Pulp. Harry C. Ayerst, Milwaukee, Wis., assignor to Sanitary Pulp Products Co., Spokane, Wash.—1,525,163.

Composition of Matter and Method of Making Same. James L. Stevens, Hayden, Ariz.—1,525,211.

Open-Fire Tunnel Kiln. Phillip D'Huc Dressler, Cleveland, Ohio, assignor to American Dressler Tunnel Kilns, Inc., Cleveland, Ohio.—1,525,232.

Process of Emulsifying Milk Fat. Charles Edward North, Montclair, N. J., assignor to the Milk Oil Corporation, Wilmington, Del.—1,525,251.

Extract and Method of Making Same. William A. Darrah, Chicago, Ill.—1,525,272.

Method for Treating Petroleum. Carbon P. Dubbs, Wilmette, Ill., assignor to Universal Oil Products Co.—1,525,281.

Process for the Recovery of Spent Plumbite. Anthony Kinsel, Everett, Mass.—1,525,301.

Solution Process. Harry D. Lathrop and Walter H. Paulson, Chicago, Ill. said Paulson assignor to said Lathrop.—1,525,304.

Process of Preparation of Pearl Essence. Jean Paisseau, Paris, France.—1,525,317.

Refractory Material. James E. Sheaffer, Burnham, Pa.—1,525,328.

Process for the Manufacture of Sulphuric Acid. Wilhelm Franck, Mannheim-Wohlgelegen, Germany, assignor to Firm of Sulfur-Aktiengesellschaft, Zurich, Switzerland.—1,525,382.

Mixing and Agitating Apparatus. George Juer, Philadelphia, Pa., assignor to Tubize Artificial Silk Co. of America, Wilmington, Del.—1,525,395.

Continuous Process of Solidification of Liquid Hydrocarbons. Hippolyte Neveu, Paris, France.—1,525,409.

Method of Producing Motor Fuel. Henry Clay Wade, Los Angeles, Calif.—1,525,421.

New Publications

University of Missouri Bulletin, "Experiments on the Extraction and Recovery of Radium From Typical American Carnotite Ores, Including Contributions to Methods of Measuring Radium," by *Howard H. Barker*, with the collaboration of *Herman Schlundt.*

U. S. Geological Survey

"Copper in 1923," by *Helena M. Meyer.*

"Potash in 1923," by *George Rogers Mansfield* and *Leona Boardman.*

"Stone in 1923," by *G. F. Loughlin* and *A. T. Coons.*

"Phosphate Rock in 1923," by *George Rogers Mansfield.*

"Lime in 1923," by *G. F. Loughlin* and *A. T. Coons.*

"Feldspar in 1923," by *Jefferson Middleton.*

Important Articles in Current Foreign Literature

"Driers." *W. Graulich.* Use of preheated air in industrial driers; relation of area of heating surface to rate and efficiency of drying; utilization of waste heat from driers. *Chem.-Ztg.*, Nov. 27, 1924, pp. 876-7.

"Recent Advances in the Manufacture of Celluloid and Its Substitutes." *Schmidt.* A review of the patent literature, with particular emphasis on American practice. *Kunststoffe*, November, 1924, pp. 167-70.

"Manufacture of Silver Nitrate on a Factory Scale." Commercial application of the method of dissolving Ag in HNO_3. Pure Ag (99.9 per cent) is preferable to low-grade metal or to alloys, though the latter can be used. The cost of manufacture, based on prewar prices, is figured at 15.75 marks per kilo of $AgNO_3$, exclusive of overhead charges. *Chem.-Ztg.*, Jan. 1, 1925, p. 5.

"Manufacture of Silica Brick." *H. Schilling.* The properties of silica brick for refractory uses depend on obtaining a network of crystals of tridymite. Great care is necessary in temperature control so that the finished brick shall be a conglomerate of crystalline tridymite with Ca silicate acting as a binder. If any other binding ingredients are added, they must not contain sulphur, which would cause formation of $CaSO_4$ and destroy the effect of the lime. *Chem.-Ztg.*, Jan. 1, 1925, pp. 6-7.

News of the Industry

Summary of the Week

Senate committee disagrees with House amendments to helium bill.

Conferees on Muscle Shoals bill report to Senate and House.

Syracuse University professor called to England to organize department of wood technology.

The Tariff Commission is expected to complete its report on linseed oil before the end of the month.

Congested calendar of the Senate may prevent action on Sterling-Cramton bill at present session.

The Wintershall interests are reported to be on the point of obtaining control of 55 per cent of German potash production.

New Jersey Grand Jury exonerates Standard Oil Co. in Bayway deaths from tetra-ethyl lead poisoning and ban on ethyl gasoline will be raised.

Tariff Report on Linseed Oil Expected This Month

The Tariff Commission has about completed its report on linseed oil, on which a reduction of duty was sought under the terms of the flexible tariff, and may be expected to submit its findings to the President before the end of the month. Indications are that a slight reduction in the duty will be shown to be justified, although this is a matter of uncertainty.

The Chemical Division of the commission has made rapid progress with its report of field investigations into the costs of producing cottonseed oil, peanut oil, soya-bean oil and coconut oil, the vegetable oil case, so that within another 3 weeks it is expected the data will be placed before the commission for issuance as a preliminary report. The commission then will be able to set a date for hearing in this case. Reductions are sought in the duties on these oils, also.

Magnesite Producers Urge Tariff Investigation

With only three properties working, domestic producers of caustic magnesite feel that they are being neglected by the Tariff Commission, which for 2 years has had their application for a 50 per cent duty increase before it. Domestic producers are making and selling less than they were a year ago. At the same time the importers are importing and selling more than a year ago. The line that marks the limit of region in which domestic caustic magnesite can compete is moving steadily westward.

As the volume of home production decreases, the costs of production mount. Stanley H. Barrows, the president of the Sierra Magnesite Co. of Porterville, Calif., recently conferred with the Tariff Commission on behalf of domestic producers and is encouraged to believe that the case will be taken up again in the near future.

It is recognized that the commission faces unusual difficulties in this case because of the question as to how far transportation costs may be considered a part of the cost of production. Some of the imported magnesite is ground in this country, consequently production is not completed until its arrival here. The Grecian product is ground for the most part in Holland, so even in that case a transportation charge enters before production is completed. From the $721,000 which Congress is just now voting the commission, the feeling is that it has ample resources to permit of the assembly of facts, a step that must be taken before the industry can come within hailing distance of relief.

Wintershall Interests Seek Potash Control

The Wintershall Konzern appears to be on the point of becoming the dominant influence in German potash production. It is about to absorb the former state operations in Prussia. An arrangement also is being completed with the Burbach Konzern. When these negotiations are perfected, the Wintershall combination will control 55 per cent of Germany's potash production. This has the highest significance, as the Wintershall interests stand for a drastic change in sales policy. This ambitious concern has been urging the increase of sales by drastic price reductions. It would close the less efficient properties and speed up production from the low-cost operations. A possibility of the situation is that the Prussian Government may take a hand in the matter and prevent the Wintershall concern from securing control or at least prevent the launching of any precipitate about-face policy.

Jury Clears Bayway Corporation in Lead Poisoning Cases

The deaths and serious cases of lead poisoning incurred last October in the manufacture of tetra-ethyl lead at the Bayway plant of the Standard Oil Co. of New Jersey were not due to carelessness on the part of the men's employers, according to the findings of the Union County Grand Jury, which were reported to Judge Stein at Elizabeth, N. J., on February 11. The jury held that the company had made every effort to safeguard the workmen and to warn them of the hazards in their occupation. Since the outbreak of the poisoning the Bayway plant has been closed and the tetra-ethyl lead has been manufactured by the dyestuffs department of the du Pont company at Deepwater, N. J. At the latter works a new plant involving every conceivable safety precaution has been in successful operation for several months.

Following the report of the Grand Jury, Prosecutor David announced that he would direct the Elizabeth Board of Health to lift the ban on ethyl gasoline which has been in effect since the Bayway deaths.

Senate Committee Amends Helium Bill Passed by the House

With one exception none of the House amendments to the helium bill met with the approval of the Senate Committee on Military Affairs. It has reported out the bill approved by the House Committee on Military Affairs. The amendment requiring the purchase of helium from private producers when offered at less than the cost of government manufacture was retained.

The House amended the helium bill so as to place control of production and repurification in the sole charge of the Secretary of the Navy, thus making the army entirely dependent on the navy for its supply of helium.

News in Brief

Canadian Paper Export Figures for 1924—Exports of pulp and paper from Canada for the calendar year 1924 amounted to $139,491,469, a decline of $1,306,984 compared with 1923, but exports for the month of December, totaling $13,026,919, show an increase of $1,261,488 over November and of $1,352,731 over December, 1923. Paper exports for the year were $99,248,497, an increase of $5,477,540, while woodpulp exports were $40,242,972, a decrease of $6,784,524.

Ceramic Engineering Course at Toronto Assured—At the annual meeting of the National Clay Products Association in Montreal, the announcement was made that practically the whole sum required for the institution of a course in ceramic engineering at the University of Toronto had been pledged by members of the association. Andrew Dodds of Mimico, Ont., was chosen president for the ensuing year, and the following were chosen vice-presidents: D. C. Merkley, Ottawa; B. McFarren, Toronto, and H. F. Bingledine, Aldershot, Ont. The secretary is Gordon C. Keith of Toronto.

New Byproducts Gas and Coke-Oven Plant at Troy—The Hudson Valley Coke & Products Corporation, Troy, N. Y., recently organized as an interest of the Burden Iron Co., has construction under way on a new byproducts gas and coke-oven plant. The plant will have an initial installation of fifty-five coke ovens, with rating of 8,300,000 cu.ft. of gas per day and 315,000 tons of coke per year. It is planned later to install water-gas generating apparatus, increasing the output to 16,000,000 cu.ft. daily. The company has closed contracts for the entire gas production with public utilities now furnishing service at Albany, Troy, Schenectady and vicinity. The company has also acquired from the Burden Iron Co. an existing blast furnace on a 40-acre tract of land near Troy, and plans rebuilding and remodeling to develop a capacity of about 13,000 tons of pig iron per month. In addition to previous financing, arrangements have been perfected for a note issue of $1,000,000, practically the entire proceeds to be used in connection with the expansion. James A. Burden is president.

Sanitary Ware Plant Expanding—The General Ceramics Co., Metuchen, N. J., with headquarters at 50 Church St., New York, has authorized plans for extensions in its sanitary ware manufacturing plant, known as Plant No. 2, estimated to cost close to $250,000, including equipment. The installation will include a Shaw gas kiln, to be furnished by the Shaw Gas Kiln Co., an interest closely allied with the General Ceramics organization. It is expected to proceed with the work at an early date.

Addition to Washington Paper Mill—The Inland Empire Paper Co., Millwood, Wash., has authorized the immediate erection of a new addition at its mill to cost close to $135,000. A contract for the structure has been let to the Austin Co., Dexter-Horton Building, Seattle, Wash., and work will begin at an early date. The structure will be used primarily as a machine room, and arrangements for equipment installation will soon be made.

Beet Sugar Mill in Montana—Officials of the Holly Sugar Co., Kittredge Building, Denver, Colo., have organized a new company to be known as the Midland Sugar Co., capitalized at 10,000 shares of stock, no par value. The new organization has selected a site at Sidney, Mont., for a new beet sugar refinery, and has asked bids on structural steel framework for the initial buildings. It will consist of several one-story units, with power house, machine shop and auxiliary structures. The parent organization acquired the Anaheim Sugar Co., Anaheim, Calif., some months ago, and purposes to dismantle this plant and remove to the new location, with the installation of additional equipment in different departments. The plant site is located in the Lower Yellowstone Valley, and arrangements have been made for planting a large crop of sugar beets.

New England Chapter of Chemical Warfare Service—Regular and reserve officers of the Army Chemical Warfare Service located in the New England district have perfected plans for the establishment of a New England Chapter of the organization. Those instrumental in the formation include Captain Thomas J. Johnson, C.W.S. officer for the First Corps Area, and Lieutenant Alden H. Waitt, executive officer of the First Procurement District, with headquarters at Boston.

Research Graduate Assistantships Open at University of Illinois

To assist in the conduct of engineering research and to extend and strengthen the field of its graduate work in engineering, the University of Illinois maintains fourteen research graduate assistantships in the Engineering Experiment Station. Two other such assistantships have been established under the patronage of the Illinois Gas Association. These assistantships, for each of which there is an annual stipend of $600 and freedom from all fees except the matriculation and diploma fees, are open to graduates of approved American and foreign universities and technical schools who are prepared to undertake graduate study in engineering, physics, or applied chemistry.

An appointment to the position of research graduate assistant is made and must be accepted for two consecutive collegiate years of 10 months each, at the expiration of which period, if all requirements have been met, the degree of Master of Science will be conferred. Half of the time of a research graduate assistant (approximately 900 clock hours for each 10-month period) is required in connection with the work of the department to which he is assigned, the remainder being available for graduate study.

Nominations to these positions, accompanied by assignments to special departments of the Engineering Experiment Station, are made from applications received by the director of the station each year not later than the first day of April. The nominations are made by the executive staff of the station, subject to the approval of the president of the university. Nominations are based upon the character, scholastic attainments, and promise of success in the principal line of study or research to which the candidate proposes to devote himself. Preference is given those applicants who have had some practical engineering experience following the completion of their undergraduate work. Appointments are made in the spring, and they become effective the first day of the following September. Vacancies may be filled by similar nominations and appointments at other times. Blank applications will be furnished on request.

January Imports of Dyes Through Port of New York

The imports of coal-tar dyes for January, 1925, through the port of New York totaled 393,525 lb., with an invoice value of $350,206. Imports of dyes through other ports include: Boston, 9,458 lb., valued at $8,177; Hartford, 1,000 lb., valued at $980; and Philadelphia, 1 lb., valued at $13. The total imports of dyes during January were 403,984 lb., with an invoice value of $359,376.

DYES REMAINING IN BONDED CUSTOMS WAREHOUSE

Date	Coal-Tar Dyes and Colors, Lb.	Coal-Tar Intermediates, Lb.
Aug. 31	507,338	1,081,287
Sept. 30	559,661	1,111,656
Oct. 31	552,556	1,050,037
Nov. 30	533,760	1,031,460
Dec. 31	575,051	1,086,108

SEVEN LEADING DYES BY QUANTITY IMPORTED

	Lb.		Lb.
Ciba violet R	44,090	Rhodamine 6G	11,075
Patent blue V	14,226	Anthraflavone G	10,279
Algol brown R	12,839	Ind. yellow	10,183
Ind. blue GCD	11,088		

Butterworth-Judson Plant Is Sold at Auction

The plant of the Butterworth-Judson Corporation, located at Newark Bay, Newark, N. J., was sold at auction last Tuesday. The F. J. Lewis Manufacturing Co. of Chicago with an offer of $757,000 was the highest bidder. Mr. Lewis was the successful bidder at the previous sale, when the property was offered in separate units, he having been the high bidder for two of the four waterfront parcels. His chief competitor at yesterday's sale was Theodore Friedeberg of Manhattan, whose business is the buying of obsolete plants, the demolishing and disposing of them in lots.

Washington News

Opposition May Delay Passage of Sterling-Cramton Bill

Opponents of the Sterling-Cramton prohibition bureau bill appear to believe that by a process of delay they can succeed in killing this measure so far as the present Congress is concerned.

The majority report of the Judiciary Committee has been filed, recommending passage of the measure with important amendments, but the minority report of Senator Reed of Missouri has not been presented and at this writing Senator Reed said he was not certain when he could find time to prepare his views.

Any determined opposition by even a handful of Senators, and this seems assured, would jeopardize the bill's passage because of the time element. The calendar of the Senate is so congested that it is certain few controversial measures will be brought forward to any determination. Several filibusters are in the air already and administration leaders are feeling their way carefully as to measures that are to be pressed for passage before March 4.

Private Operation of Muscle Shoals Favored in Conference Bill

As a result of the report of the Senate and House conferees on Muscle Shoals legislation, there is a very general feeling in Washington that a lessee will soon be found for this troublesome property. This is some relief to administrative officials, who look with great apprehension upon government manufacture of nitrogen to be distributed to the public.

The fertilizer industry, however, sees in either private operation or the alternative of governmental operation the subsidizing of an activity which is to compete with its established business. That industry fully expects some one to come forward under the provisions of the leasing feature of the bill, when the lessee will receive the benefit of a subsidy which is figured at the equivalent of nearly $1,500,000 annually.

In spite of the fact that the conferees' bill is distinctly favorable to private enterprise rather than to government operation of this project, considerable criticism of the proposed measure has been aroused by certain minor but obvious defects. It is apparent that nitrogen production was the foremost consideration in the minds of the conference, which consisted of Senators Keyes, McKinley and Kendrick and Representatives McKenzie, Morin and Quin. Those whose major interest is in power distribution believe that by inserting the provision that the property must be leased as a whole the conferees have precluded the possibility of coordinating fertilizer manufacture and power production. They have no objection to allowing nitrogen production to have the first call on such power as it needs. Since those needs of power could be anticipated a year or more in advance, the distributing interests would have time to take care of their own needs before they were called upon to turn the power over to the fertilizer manufacture. Under the conditions of the conference bill, however, the power becomes subject to all the vicissitudes of the fertilizer company. Since this provision carries no benefit to anyone concerned, the power distributors are at a loss to understand why it was inserted.

Production of Methanol and Acetate of Lime

A report has been issued by the Department of Commerce showing domestic production of methanol and acetate of lime in 1924. The total for acetate of lime is placed at 128,942,544 lb., as compared with 164,396,124 lb. in 1923. The output of methanol also showed a sharp decline, the totals being 6,893,291 gal. in 1924 and 8,593,727 gal. in 1923. Following are statistics for monthly production and stocks in 1924:

ACETATE OF LIME

	Production	Stocks, End of Month
Jan.	13,420,193	23,410,511
Feb.	13,172,610	27,622,967
March	14,107,411	32,370,329
April	12,650,393	30,534,533
May	11,538,625	33,985,853
June	9,396,138	32,291,427
July	7,713,750	23,756,732
Aug.	8,112,277	19,764,496
Sept.	8,449,457	18,069,783
Oct.	9,803,414	15,259,078
Nov.	10,305,653	11,854,988
Dec.	10,272,623	13,498,891

METHANOL

	Production	Stocks, End of Month
Jan.	705,747	2,632,633
Feb.	690,403	2,738,308
March	741,505	2,749,818
April	698,126	2,656,211
May	625,107	2,615,144
June	492,902	2,368,760
July	408,132	1,873,932
Aug.	444,612	1,797,729
Sept.	464,702	1,656,499
Oct.	539,333	1,551,678
Nov.	560,904	1,370,862
Dec.	523,818	1,315,166

German Thomas Slag Producers Complain of Lost Markets

The Germans are complaining of unhealthy conditions in the Thomas slag market, states a report from Trade Commissioner William T. Daugherty, Berlin. They maintain that the former quasi-monopoly control of the old Thomas Slag Syndicate in Berlin, with its European branches, has been replaced by a looser organization, and that the existing Union of Thomas Slag Producers is not disposing of its product as before the war.

The unavoidable consequences of the war have dislocated production and distribution, of course, but the acute need of German soil for P_2O_5 in Thomas slag, perhaps more desirable here, as it also contains calcium, in which German soil is equally deficient, would seem to make better distributing facilities imperative.

Germany is doubtless producing about 1,000,000 tons of Thomas slag annually, with a P_2O_5 content of about 160,000 tons. A pre-war production of more than 2,000,000 tons Thomas slag was controlled more or less by the syndicate, but now a number of outsiders are apparently in the market, without safe guarantees that they can deliver at prices quoted. The operations of the latter, it is said, are reacting unfavorably on the local market.

At the present time, German steel works except those lost by war belong to the Union. This Union is more of a propaganda organization now, as most producers have their own sales departments and have even enlisted or organized special commercial companies to sell for them. Lorraine, French and Belgian producers are also selling their own product, with French dumps apparently overstocked with the raw material, despite an increased consumption in France and vigorous efforts by the French to keep their stocks moving.

One suggestion made here to improve the marketing of Thomas slag is to restore the old pre-war syndicate, or its equivalent. The former Berlin headquarters should be moved, say to Luxembourg, the central point of the European steel industry. A branch could be opened in Berlin to sell German and east European customers, while Paris could sell western Europe. Other branches are suggested at Antwerp and Rotterdam.

Dearth of Chemical Products in Soviet Union

A report from Moscow states that there is a great lack of chemical products, both imported and home manufactured, at the present time in the Soviet Union. The prices for tanning extracts are 20 to 25 per cent above the normal. The scarcity of aniline dyes is felt acutely. There is practically no coconut oil on the market.

U. S. Chamber of Commerce Annual Meeting in May

The thirteenth annual meeting of the Chamber of Commerce of the United States will be held in Washington, D.C., on May 20, 21 and 22. The full program has not yet been announced, but on the evening of May 20 the new building of the National Chamber will be formally dedicated and it will be used throughout the meetings as headquarters for registration, group meetings and general sessions, with the exception of the larger sessions, which will be held in the new Washington auditorium.

Auction Sale of Oil Lands

The Department of the Interior has authorized the sale by auction of oil leases on 56,000 acres of land in the Osage Indian reservation in Oklahoma. The sale will take place at Pawhuska, Okla., on March 18.

Surplus Acid Stocks in Germany

South Germany has a surplus of sulphuric acid, say reports to the Department of Commerce. Export prices are quoted as being £6 15s. per 1,000 kg.

Trade Notes

Changes in Argentine export duties for February include an advance from 4.11 pesos to 4.32 pesos a metric ton on shipments of linseed.

The January sales of the German Potash Syndicate totaled 182,380 tons. The syndicate anticipates equally brisk business this month.

Thomas P. Beal has been elected president of the Hamilton Woolen Co. to succeed the late William H. Wellington.

The Conradi Chemical Co. has begun the manufacture of insecticides and fungicides at Columbia, S. C. H. G. Kaminer is president, A. F. Conradi is vice-president and manufacturing director; H. Volrath, is secretary-treasurer.

Horace E. Hall, formerly sales manager of the Commercial Solvents Corporation, will act in a similar capacity for the Butyl Corporation of Peoria, Ill., which will manufacture butyl alcohol. Mr. Hall will make his headquarters in New York.

The B. F. Goodrich Co. has acquired the Ames-Holden Tire Co., Ltd., of Canada and the name of the latter will be changed to Canadian Goodrich Rubber Co., Ltd.

John W. Davis has been elected director of the U. S. Rubber Co. and appointed general counsel of the company.

Bell Telephone System Forms New Company for Research Work

The growth of the research and development work of the Bell system has led to the formation of Bell Telephone Laboratories, Inc., organized on Jan. 1, for the purpose of carrying on development and research activities in the communication and allied fields.

This new company, which is jointly owned by the American Telephone & Telegraph Co. and the Western Electric Co., Inc., has taken over the personnel, buildings and equipment of the research laboratories of these two companies, which were formerly operated as the engineering department of the Western Electric Co.

Extensions of laboratory facilities for the scientists and engineers of the new corporation are already under way. Laboratory space in the form of a new building covering almost a quarter of a city block will be added to the 400,000 sq.ft. at present in service in the group of buildings at 463 West St., New York City. At the date of incorporation, the personnel numbered approximately 3,600, of whom about 2,000 are members of the technical staff, made up of engineers, physicists, chemists, metallurgists and experts in various fields of technical endeavor.

The formation of Bell Telephone Laboratories, Inc., provides an individual organization, the whole activities of which may be more efficiently devoted to the furtherance of research, development and engineering investigations along the line in which the parent companies have already made such remarkable progress. Its formation is an indication of the estimate which these companies place upon the importance of properly organized research and is a promise of continuous service to the public, to the communication art and to the progress of science.

Du Pont to Have a Synthetic Ammonia Plant in Virginia

A plant side for the manufacture of synthetic ammonia has been purchased at Clinchfield, Va., by Lazote, Inc., a corporation organized by E. I. du Pont de Nemours & Co. The new corporation, after careful study of the several known processes, has acquired the Claude synthetic ammonia process and will install it in the plant to be built on this site.

Field work and construction operations will be started in the early spring and it is expected to have it in operation by the end of the year. Plans for the plant provide for a capacity of 25 tons of ammonia a day and they are so drawn as to allow for substantial enlargement.

The site selected at Clinchfield is next to coal fields, which will supply the necessary power and raw material, investigations having shown that in the synthetic ammonia process, coal or coke can be used more economically than water power in the production of the essential raw materials, it heretofore having been considered necessary to have cheap hydro-electric power for the operation of synthetic ammonia or fixed nitrogen processes.

The special equipment and machinery which will be required in the Lazote plant now is being constructed in the shops of the du Pont company and will be ready for installation by the time the buildings are complete.

Industrial Notes

At a meeting of the Alpha Portland Cement Co., Easton, Pa., G. S. Brown was re-elected president. Other officers elected for the ensuing year are: Frank G. McKelvey, F. M. Coogan and C. A. Irvin, vice-presidents; John G. Matthes, treasurer; Robert S. Gerstell, secretary; F. G. Lyons and W. E. Viets, assistant secretaries and assistant treasurers.

The Scott Valve Manufacturing Co. of Detroit, Mich., has appointed Russell F. Kleinman, Land Title Building, Philadelphia, Pa., as its sales representative. Mr. Kleinman will handle the complete line of Scott bronze and iron body valves in eastern Pennsylvania, southern New Jersey, Maryland, Delaware and the District of Columbia. This company has also appointed the Charles H. Tinker Co., 201 Devonshire St., Boston, Mass., as New England representative for the Scott lines of bronze and iron body valves.

The Blodgett Engineering & Tool Co. of Detroit has added Roy Gill to its sales organization.

Financial

The statement of the Davison Chemical Co., excluding the Davison Sulphur & Phosphate Co., for the year ended Dec. 31 shows net income of $66,483. This compares with a deficit in 1923 of $356,983.

Net profit of Archer-Daniels-Midland Co. and subsidiaries for the quarter ended Dec. 31 was $598,523 after all charges, including federal taxes.

The American Can Co. for the year ended Dec. 31 reports net income of $11,341,931 after charges and federal taxes, equivalent, after preferred dividends, to $20.50 a share earned on $41,233,300 common stock. This compares with $10,983,094, or $19.63 a share, in 1923.

The Hercules Powder Co. reports for the year ended Dec. 31 net income of $2,156,901 after charges and taxes, equivalent, after preferred dividends, to $10.02 a share earned on $14,300,000 common stock, against $2,508,669, or $12.57 a share, in 1923.

The Goodyear Tire & Rubber Co. for the year ended Dec. 31 reports net income of $12,161,540, equivalent, after deducting prior dividends, to $16.92 a share on outstanding preferred stock on which no dividends have been paid since Oct. 1, 1920. Allowing for regular dividend requirements on preferred stock the balance is equivalent to $7.76 a share on outstanding no par common stock.

England Calls Syracuse Professor

Prof. Carl C. Forsaith, associated with Dr. Brown in the Department of Wood Technology, New York State College of Forestry, Syracuse University, has accepted an offer from the English Government through the Imperial Forestry Institute at the University of Oxford to organize a department of wood technology at that university. As collateral to his work Dr. Forsaith will instruct students in wood technology and carry on such investigations bearing on wood technology as may be directed by the officials of the Imperial Forestry Institute. Dr. Forsaith will leave the College of Forestry at the end of the present semester and will sail on June 2 on the S.S. "Montcalm" from Montreal.

The Imperial Forestry Institute in a way corresponds to the United States Forest Products Laboratory at Madison, Wis., in which many of the major research problems in forestry are carried on, especially those relating to the composition, fiber, characteristics, stresses and strains of various kinds of wood, the adaptability of certain species for specific purposes and the effect that many preservatives and destructive agencies have upon commercial wood products.

Dr. Forsaith was graduated from Dartmouth in 1913 with the degree A.B. Subsequently he won the degrees A.M. and Ph.D. at Harvard.

Men You Should Know About

Prof. J. L. BRAY of Purdue University has been appointed a Captain in the Chemical Warfare Section, Officers Reserve Corps.

H. M. BREIDENTHAL has been elected secretary of the Lion Oil Refining Co., Eldorado, Ark. He was formerly secretary of the White Eagle Oil Co.

H. S. BROWN, president of the Sinclair Oil Co., New York, has left for a business trip to Mexico City, Mexico.

L. T. BUTMAN has been re-elected president of the Kalamazoo Asbestoloid Products Co., Kalamazoo, Mich.

A. CLAYTON CLARK, superintendent of the Raritan Copper Works, Perth Amboy, N. J., has been re-elected president of the local Board of Education.

WILLIAM CROWLEY and F. W. BOMMER, both of the Lambertville Rubber Co., Lambertville, N. J., gave addresses before the members of the local Rotary Club, Jan. 24, dealing with rubber manufacture.

Dr. C. E. DAVIS, chief chemist of the National Biscuit Co., New York, gave an interesting address before the members of the Maryland Section of the American Chemical Society, at the Engineers Club, Baltimore, Jan. 30.

EDWARD L. DOHENY, head of the Doheny oil interests, Los Angeles, Calif., is in Mexico City, Mexico, on a business trip.

Prof. F. S. EARLE has become connected with the Tropical Plant Research Foundation as sugar cane technologist, and for some weeks to come will be engaged in conducting a series of tests at his home farm at Herradura, Cuba. Professor Earle heretofore has been connected with the General Sugar Co.

M. C. FOLZENLOGEN of the Procter & Gamble Co., Cincinnati, Ohio, manufacturer of soaps, etc., located at Dallas, Tex., addressed the members of the Central Texas Section of the American Chemical Society, at Waco, Tex., on Jan. 24.

JOHN GAILLARD has resigned as staff engineer for the American Engineering Standards Committee, to become connected with the American Radiator Co., where he will be in charge of technical standardization work for the various plants of the company. S. J. KOSHKIN will succeed Mr. Gaillard with the American Engineering Standards Committee.

Judge ELBERT H. GARY, chairman of the board of directors of the United States Steel Corporation, was a guest of honor at a dinner of the board of trustees of the University of Pittsburgh, William Penn Hotel, Pittsburgh, Pa., Jan. 29.

W. L. HAWES, who was formerly chemical engineer for the du Pont Nitrate Co. at Iquique, Chile, is now in the explosives division of the same company, doing research work at the Easton laboratory, Chester, Pa.

O. B. HOPKINS, an official of the International Petroleum Co., New York, has sailed for a trip to South America, accompanied by Mrs. Hopkins.

Dr. V. N. KRIVOBOK, associate professor of metallurgical research, Carnegie Institute of Technology, Pittsburgh, Pa., gave an instructive address before the members of the Pittsburgh chapter of the American Society for Steel Treating at the Fort Pitt Hotel, Feb. 3, on the subject "Some New Facts Regarding Dendritic Segregation."

O. C. MARTIN, an official of the Nichols Copper Co., New York, has sailed for London, England, and will be absent a number of weeks.

LEROY H. MINTON, general superintendent of the General Ceramics Co., Metuchen, N. J., gave a talk on business ethics with regard to the relationship between employer and employee at the Rotary Club meeting at Perth Amboy, Feb. 4.

Prof. JAMES F. NORRIS, president of the American Chemical Society and chairman of the division of chemistry and chemical technology, National Research Council, addressed the Chemical Society of Washington, Feb. 12, speaking on "The Reactivity of Atoms and Groups in Organic Compounds."

LOYALL A. OSBORNE, president of the Westinghouse Electric International Co., New York, has sailed for a business trip to France and Italy, to be absent for about 6 weeks.

DAVID B. RUSHMORE, one of the consulting engineers of the General Electric Co., has resigned his position, and is now located in New York City, with headquarters at the University Club. His resignation followed orders from his physician to take a long rest and avoid desk work.

CHARLES M. SCHWAB, chairman of the board of directors, Bethelhem Steel Co., Bethlehem, Pa., has left for a 6 weeks business trip abroad. He will spend most of the time in France.

W. M. B. SINE, president of the Clarksburg Glass Co., Clarksburg, W. Va., gave an address before the members of the local Board of Trade, Jan. 26, on the subject "Window Glass and Its Making."

CHARLES R. SPARE, president of the American Manganese Bronze Co. Philadelphia, has been elected president of the Philadelphia Foundrymen's Association.

JOHN T. WATKINS has been re-elected president of the Lansing Color & Paint Co., Lansing, Mich.

R. W. STRAUS of the American Smelting & Refining Co., New York, has sailed for South America, accompanied by Mrs. Straus, and will be absent for a number of weeks.

At a recent meeting of the American Waxed Paper Manufacturers Association, W. L. CARTER, of Nashua, N. H., was elected president for the ensuing year. C. R. DONNELLEY, of Chicago, Ill., was elected Western vice-president; A. H. HAVEMAYER, of Springfield, Mass., was elected Eastern vice-president; and O. M. PORTER, of New York, was elected secretary and treasurer.

Calendar

AMERICAN CERAMIC SOCIETY, annual meeting, Columbus, Ohio, Feb. 16 to 21.

AMERICAN CHEMICAL SOCIETY, New York Section, March 6.

AMERICAN CONCRETE INSTITUTE, annual meeting, Chicago, Ill., Feb. 24 to 27.

AMERICAN ELECTROCHEMICAL SOCIETY, Niagara Falls, April 23 to 25.

AMERICAN INSTITUTE OF CHEMICAL ENGINEERS, semi-annual meeting, Providence-Biltmore Hotel, Providence, R. I., June 22 to 25.

AMERICAN INSTITUTE OF MINING AND METALLURGICAL ENGINEERS, annual meeting, New York City, Feb. 16 to 19.

AMERICAN PULP AND PAPER MILL SUPERINTENDENTS ASSOCIATION, Niagara Falls, N. Y., June 4 to 6.

AMERICAN SOCIETY FOR TESTING MATERIALS, annual meeting, Atlantic City, June 22 to 26.

CHEMICAL EQUIPMENT EXPOSITION, Association of Chemical Equipment Manufacturers, State Armory, Providence, R. I., June 22 to 27.

BRUSSELS INTERNATIONAL AND COMMERCIAL FAIR (sixth), Brussels, Belgium, March 25 to April 8.

NATIONAL EXPOSITION OF CHEMICAL INDUSTRIES, New York, Sept. 28 to Oct. 3.

SOCIETY OF INDUSTRIAL ENGINEERS, national convention, Hotel Winton, Cleveland, Ohio, May 6 to 8.

SOUTHERN EXPOSITION, Grand Central Palace, New York, May 11 to 23.

Obituary

LYNN B. EASTON, manager of the Laidlaw Works of the Worthington Pump & Machinery Corporation, died in Cincinnati, Ohio, Jan. 24, just before his fortieth birthday. In his 20 years of work at Laidlaw and in the sales department of the Worthington company he had held many positions, starting with that of time clerk and ending as manager of the works.

JULIUS FLEISCHMANN, head of the Fleischmann Co., yeast maker, died of heart disease Feb. 5, while playing a game of polo at the Nautilus Polo Field, Miami, Fla. Mr. Fleischmann was 53 years old.

HENRY W. HEMINGWAY of London, England, well known British chemist, metallurgist and manufacturer of chemicals, died at his home, Jan. 15, aged 83 years.

Dr. WILLIAM FRANCIS HILLEBRAND, chief chemist of the Bureau of Standards, past president of the American Chemical Society and an international figure in analytical chemistry, died Saturday Feb. 7, at George Washington University Hospital following an abdominal operation Wednesday.

Born at Honolulu, Dec. 12, 1853, environment favored the development of an interest in science, for his father was not only a physician but a botanist whose garden is still one of the show places in Honolulu. Experiences in the Sandwich Islands, Japan and California strengthened the love for nature and science and in his eighteenth year he entered Cornell. At the end of his sophomore year at Cornell Dr. Hillebrand began his studies in Germany, at first under Bunsen. In 1875, with T. H. Norton, he was the first to prepare metallic cerium, lanthanum and what was then called "didymium." His determination of the specific heats of these metals showed for the first time that they are trivalent and therefore not members of the calcium family, as had been supposed. He discovered that cerium gives off sparks when filed. Decades later this behavior came to be of commercial value for gas lighters.

Another discovery of far greater economic importance is recalled. In 1904, Dr. Hillebrand called attention to the possibility of recovering and utilizing the enormous quantities of potash that are volatilized during the clinkering of portland cement. He is too seldom given credit for suggesting what is now an accomplished fact.

After leaving Heidelberg Dr. Hillebrand studied for a time under Fittig at Strassburg. This was his only digression into organic chemistry, but even then one of the two papers he wrote at that time was a crystallographic study. He returned to his proper field when he went to the Mining Academy at Freiberg, and never afterward left it. For a while he worked as assayer at Leadville in its roaring days. Then followed a period of 5 years, 1880 to 1885, at Denver with the Geological Survey, after which he was transferred to Washington, where he spent the rest of his life. He became chief chemist of the Bureau of Standards in 1908.

Utmost accuracy of analytical methods was the basis of Dr. Hillebrand's life work. In the field of mineral and rock analysis particularly he carried this work to such a high plane that he was recognized throughout the world as the foremost authority on this phase of chemistry. His methods have been preserved in a series of geological survey bulletins on the analysis of silicate and carbonate rocks. These merit a place among the classic works of chemistry. His determinations of the exact nature of those rock constituents which are present only in minute quantities have frequently been of exceptional value to the geologist in indicating unsuspected differences or similarities.

©Harris & Ewing

Dr. William Francis Hillebrand

Honesty in analytical work cannot but have its influence upon the daily life and contacts of him who practices it. Dr. Hillebrand once said that he was selected as chief chemist of the Bureau of Standards because of his reputation as an analyst. Perhaps it has never occurred to him that unwavering integrity in all his dealings may have had more to do with his selection than he suspected.

Dr. Hillebrand's attention to apparently trifling details is well illustrated by his account of the discovery of the gas which years later he called to the attention of Ramsay, who showed it to be helium. In 1890 he observed the slow and long-continued evolution of tiny bubbles from a sample of uraninite that had been treated with hydrochloric acid in a test tube. He found that the gas was neither carbon dioxide nor hydrogen sulphide, and he is not to be blamed for thinking that it was nitrogen. Nothing better exemplifies Dr. Hillebrand's self-effacement than this placing of a possibly great discovery in Ramsay's hands.

Early in 1906, during his term as president of the American Chemical Society, he was told of the rumors of a split in the society because so many of the industrial men felt that they were receiving scant attention in the one journal then published. Prompt action was taken and much of the credit for the establishment of the *Journal of Industrial & Engineering Chemistry* thus belongs to Dr. Hillebrand. For a long time he was on the editorial boards of the scientific and industrial journals of the society and for many years was chairman of the supervisory committee on standard methods of analysis. His constructive editorial criticism was not confined to papers reviewed for the journals, but extended to staff reports and correspondence, where his helpful and clarifying suggestions were of great value.

Secretary Hoover's Tribute

Secretary Hoover issued the following statement:

Through the death of Dr. William F. Hillebrand, chief chemist of the Bureau of Standards, Department of Commerce, the country not only loses one of its most illustrious government officers, who has served faithfully for 45 years, but the chemical world its dean. He had contributed more than 100 recognized works on the science of chemistry, the widest internationally known being his "Rock Analysis." His discoveries of helium in uranium, used in aircraft instead of hydrogen to lessen hazard from fire and explosion, and cerium and lanthanum, rare elements used in furthering the science of chemistry, are too well known and appreciated to require additional praise.

HARRY HUDLER, president and treasurer of the Parrott Varnish Co., Bridgeport, Conn., died at his home, Corcoran Manor, Mount Vernon, N. Y., Feb. 1. Mr. Hudler was born in Kingston County, New York. He first became connected with the varnish industry in Detroit, Mich., when he joined the firm of Berry Bros., varnish manufacturers of that city. Mr. Hudler obtained a controlling interest in the Parrott Varnish Co. of Bridgeport in 1917. He is survived by his wife and one son.

FREDERICK L. LARRABEE, of Lynn, Mass., a paper manufacturer, died suddenly at his home, Jan. 27, aged 59 years. He entered the paper industry with his brother-in-law, the late Francis L. Andrews, operating the Andrews Paper Co. Mr. Larrabee retired from the company about 4 years ago.

JAMES J. O'NEILL, of Wilmington, Del., well-known leather manufacturer, died at his home, Feb. 3, from a complication of diseases. He had been ill about 3 weeks. Born at Brooklyn, N. Y., he removed to Philadelphia, Pa., at an early age, where later he became connected with a plant manufacturing morocco leather; later he became superintendent at the Philadelphia plant of Robert H. Foerderer, Inc., manufacturer of vici kid. About 19 years ago he took charge of the plant of the Ford Morocco Co. at Wilmington, Del., and a few years later, with the late James I. Ford, organized the Wilmington Leather Co., of which he became president. The Christiania Leather Co., of the same city, was also formed by Mr. O'Neill, who was an inventor of many improvements in leather-working machinery. He is survived by his wife and six children.

FRANK W. MCSPARREN, a member of the Chemical Division of the Tariff Commission for the past 2 years, died on Feb. 4 at the Homeopathic Hospital, Washington, where he had undergone an operation for appendicitis a week before. Mr. McSparren was born in Buffalo on Feb. 14, 1893, and specialized in chemistry at Cornell University. During his service with the Tariff Commission he was sent to Argentina to investigate casein costs and last summer had charge of a field crew studying the cost of cottonseed oil in Southern states. He is survived by his mother, Mrs. William McSparren, who lived with him in Cathedral Mansions, Washington, and by a brother, C. R. McSparren of Glen Cove, L. I.

Market Conditions

Spot Buying of Chemicals Continues Along Moderate Lines

Large Contract Deliveries Supply Bulk of Consuming Needs—Prices Hold on Steady Basis

DELIVERIES of chemicals against contracts are holding up well and indicate a large consumption of most selections. Industrial operations have not expanded to a point where additional lots are required and spot transactions were not numerous during the past week. Generally speaking, the movement of chemicals is larger than was the case a year ago but new business is spasmodic with a falling off in demand reported since the first of the month.

Imported materials attract interest with chlorate of potash in a firm position. Nothing further was heard during the week regarding an increase in duty but belief in such an outcome is spreading and this has a bullish effect on values. There are also reports that applications will be made for increases in duty on some other chemicals which are now competing in our markets. Imported barium carbonate has drawn some attention because of lower selling prices and the same is true for prussiates and sal ammoniac.

The weighted index number for the week was 113.63 as compared with 113.66 for the preceding week. The slight decline was due to the easier position of some of the imported selections. Chemicals of domestic origin are marked by the firmness with which prices are maintained. The underlying strength to values is all the more significant when consideration is given to reports that buyers are not active at present and it is further enhanced because producers have a good part of their output sold ahead and are receiving withdrawal instructions with regularity.

Reports have been current in the insecticide trade to the effect that Georgia has placed contracts for calcium arsenate at 7⅞@8c. per lb. and would sell consumers at cost. Competition of this character is not regarded with favor especially as the arsenate trade has been in a protracted slump.

Latest advices from abroad would indicate that the position of potash salts is not firmly established. Control of the German potash output is said to be sought by interests which are favorable to an expansion of sales by a lowering of prices.

Acids

With the increase in duty now in effect, imports of oxalic acid have fallen off and in some quarters it is held that the market will now be controlled by domestic factors. Consumers are covered for the present and with interest slow there have been no important developments during the week. Acetic acid is under pressure as far as the higher strengths are concerned but the lower grades are fairly steady in price. Spot demand for tartaric acid is moderate and while some fair sized lots have sold for shipment, there is no general move on the part of buyers to cover ahead. Citric acid is steady in price and is receiving some attention for forward deliveries. Sulphuric acid is selling freely and consumers are taking deliveries in a larger way than has been experienced for a long time. Prices are firm and if the current movement is sustained it is probable that values will be revised upward. Nitric acid also is in good demand and values are firm not only because of the free movement but also because of the firm position of raw materials.

Lower Prices for Imported Barium Carbonate — Bichromates Maintain Steady Position—Sal Ammoniac Easy—Contract Business in Calcium Arsenate — Formaldehyde Firmly Held—Prussiates Show Easy Tendency—Large Deliveries of Alkalis—Report of Price Cutting in Bleaching Powder

Potashes

Bichromate of Potash—Demand during the week was light and buyers continue to show a preference for relatively small lots. Sales are reported at 8¾c. per lb. and this is generally held as the trading basis for small amounts. On round lots prices are subject to negotiation with reports that 8¼c. per lb. can be done.

Caustic Potash — Prices for caustic potash in the spot market have shown some range. Up to 7¾c. per lb. has been asked on an ex-warehouse while as low as 7¼c. per lb. has been named by some importers who were eager to dispose of stocks. On shipments from abroad 7¼@7½c. per lb. was quoted. Domestic sellers offer at 7½c. per lb. and upward, at works.

Chlorate of Potash—Sellers of imported chlorate have been reserved and spot supplies are said to be small. Up to 7½c. per lb. has been quoted for spot material with 7¼@7½c. per lb. covering the range of asking prices. Shipments are firm at 7c. per lb. Domestic chlorate is still quoted at 8½c. per lb. at works.

Prussiate of Potash—No improvement in demand has been felt and yellow prussiate is said to be moving only in a moderate way. Prices are unsteady inasmuch as different quotations are heard with 18@19c. per lb. expressing the difference in sellers views. Red prussiate is quiet at 37@38c. per lb.

Potash Salts—Production has been light and sellers are said to be carrying very small stocks. Buyers are not interested to any extent and sales are of small volume. Prices are given at 8½c. per lb.

Sodas

Acetate of Soda—Fair call is heard for acetate of soda against contracts but new business is not large and the spot market is rather quiet. Some producers are largely sold ahead and the absence of selling pressure holds prices at an inside figure of 5½c. per lb.

Bichromate of Soda — Fairly steady buying for prompt shipment combined with a good movement against contracts is indicative of a large consumption of this chemical. Inquiries for small lots have found prices firm and sales at 6¾c. per lb. bear out reports of firm prices. Most sellers are not openly quoting 6½c. per lb. but it is said to be the actual trading basis for round lots.

Caustic Soda—An analysis of exports in December shows that Japan took 1,531,619 lb.; Mexico, 1,506,591 lb.; Cuba, 1,313,601 lb.; Canada, 923,327 lb.; Brazil, 737,721 lb.; and Argentina, 672,000 lb. The remainder was distributed widely in smaller amounts but it is noted that Germany was returned as a buyer with 280,206 lb. shipped to that country. Trading in caustic in the past week was quiet and contract deliveries account for the greatest activity in the market. No change in prices has been made or is expected. The contract figure remains at $3.10 per 100 lb. for solid 76 per cent. Reports of lower prices have been current but are difficult to confirm. Export prices are $2.90@$3.10 per 100 lb., f.a.s.

Fluoride of Soda—Some holders of imported fluoride have been eager to sell and open quotations have shown a range according to seller. In some quarters 9c. per lb. was said to be easy with a possibility that firm bids under that level would be accepted. Other sellers were holding at 9½c. per lb. Shipments were quoted at 8¾@9c.

Nitrate of Soda—Interest in nitrate at primary points has eased off and domestic consumers also are not operating actively. There was practically no change in the market during the week and spot nitrate was quoted at $2.66@$2.67 per 100 lb.

Prussiate of Soda—Sales of prussiate on spot are reported at 10c. per lb. and some factors say that buyers would place orders only when granted concessions. Open quotations of 10¼c. per lb. were common and the tone is easy. Shipments are slightly under the spot price.

Miscellaneous Chemicals

Acetate of Lime—According to reports of producers to the Department of Commerce, the output of acetate of lime in December was 10,272,623 lb. Shipments were 8,838,509 lb. and stocks at the end of the month were 13,498,891 lb. Detailed statistics for exports of acetate of lime show that of total shipments in December, amounting to 980,145 lb., 897,494 lb. went to Japan. The remainder was distributed, 81,871 lb. to China and 780 lb. to Canada. The market for acetate of lime has held on a steady basis with sellers continuing to quote $3 per 100 lb.

Arsenate of Lead—Demand has been light and there is no outstanding feature to trading. Producers are trying to induce early buying by granting discounts on business placed before April 1. Prices are quoted at 10@12c. per lb. for paste and while powdered is quoted at 15¼c. per lb. it can be bought on cash basis for about 14¾c. per lb.

Arsenic—While some industries are taking normal amounts, the largest consuming outlet is practically closed and this tends to hold sales down and creates an unsatisfactory market. Domestic arsenic is quoted at 5¾c. per lb. Delivered and imported is nominal at 5½@6c. per lb.

Barium Carbonate—Supplies of imported carbonate of barium have increased in volume and sellers have been unable to maintain the high price levels recently quoted. Spot material is said to have been offered at $53 per ton. Shipments from abroad were quoted at the spot figure but probably could be shaded.

Bleaching Powder — In general the market is described as steady with a fair volume of contract business being placed. Many buyers have been buying for current needs because of belief that no advantage could be gained by buying ahead. The contract price of $1.90 per 100 lb. is higher than the majority of consumers paid last year but producers are a unit in putting out this quotation and there is no indication of a change. On the other hand there are unconfirmed reports that prompt material has sold as low as $1.70 per 100 lb. Producers disclaim any part in price cutting and question the accuracy of such reports.

Formaldehyde — A good call is reported for less than carlot quantities at 9¼@9½c. per lb. The tone is firm and while carlots are still to be had at 9c. per lb. producers are not eager to force matters and in some quarters higher prices are predicted. Of the 335,660 lb. exported in December, England received 180,610 lb. and Japan 100,744 lb.

Chem. & Met. Weighted Index of Chemical Prices

Base = 100 for 1913-14

This week	113.63
Last week	113.66
Feb., 1924	121.05
Feb., 1923	125.59

Larger supplies and lower prices for some of the imported chemicals brought about a slight downward revision of the weighted index number. Carbonate of barium and sal ammoniac were chief contributors to the decline.

Alcohol

Offerings of denatured alcohol have increased, but this resulted in no change in the selling schedule. The market for special, 190 proof, in drums, held at 54@55c. per gal., carload lots, shipment from works.

The call for methanol was inactive and prices were irregular in some quarters. Leading sellers still quote on the basis of 72c. per gal. on the 97 per cent material, in drums, carload lots. Production in December amounted to 523,818 gal. Production of methanol for the past year was placed at 6,893,291 gal., which compares with 8,593,727 gal. in 1923. Stocks on Dec. 31 were estimated at 1,315,166 gal., as against 2,592,298 gal. a year ago.

Coal-Tar Products

Toluene Supply Light—Solvent Naphtha Firmer—Demand for Benzene Improves—Paranitraniline Lower

WITH the exception of a few items in the intermediate list, such as paranitraniline and H-acid, the market for coal-tar products closed the week in a fairly steady position. First hands reported a steady undertone in benzene, the trade being encouraged by the continued strength in petroleum products. The price of motor gasoline and 90 per cent benzene in this territory is now on an even basis. There has been some improvement in export inquiry since the recent decline. Offerings of toluene for immediate and nearby delivery were scanty and prices ruled firm in all quarters. It was reported that production of toluene soon will be increased so as to meet the growing demands. Solvent naphtha also was firm, but quotably unchanged. Offerings of xylene were sufficient to meet trade requirements and the market was just about steady on the higher grades and unsettled on the commercial quality. Selling pressure was apparent in paranitraniline, scattered lots selling at concessions. Competition in H-acid was keen and prices named covered a wide range. Cresylic acid was in better request, but this brought out no change in the selling basis. Leading producers reported a steady market for refined naphthalene, but outside lots could have been picked up at a discount. Phenol was quiet and featureless. Advices from abroad reported a strong market for creosote oil.

Alpha-naphthylamine — Trading quiet and prices nominal, first hands quoting on the basis of 35c. per lb., in bbl., shipment from works.

Aniline Oil and Salt—Contract deliveries have been large enough to take care of production and the market remains steady, notwithstanding the slight setback so far as new business is concerned. Aniline oil is unchanged at 16c. per lb., drums extra, f.o.b. works. For small lots on spot 17c. is asked. Aniline oil for red was nominal at 38@40c. per lb. Salt quiet at 22@23c. per lb.

Benzene—No further price changes occurred in the market for benzene. The demand has gained since the recent reduction and, with a firmer situation in competing products, chiefly gasoline, distributors were inclined to take a more optimistic view of the future. In fact the undertone of the market has steadied in more than one direction. Actual production of crudes has not increased in the past fortnight, due to the less active state of the iron and steel industries. Export business has improved slightly. The market settled at 21c. per gal. on the 90 per cent grade, and 23c. per gal. on the pure, tank car basis, f.o.b. works.

Creosote Oil—Interest centered in the firmer cables from abroad. Offerings have been smaller and the tendency of prices in the leading foreign markets is upward. Manchester quoted the market at 7@7¼d. per gal., loose, works, with several sellers not inclined to shade the outside figure.

Naphthalene—Refined flake was offered at 5½c. per lb. by leading sellers, but this figure could have been shaded in some quarters. Demand is expected to pick up shortly. Chipped material was nominal, intermediate makers buying sparingly, and prices held around 4½c. per lb. Crude to import was offered at 2@2½c. per lb., c.i.f. basis.

Paranitraniline — The market was easy, business passing as low as 62c. per lb. Selling pressure was apparent at all times, while buying continues along conservative lines. Several sellers held out for 65c. and upward.

Phenol—The market was inactive and just about steady at 23@24c. per lb., the inside price prevailing on round lots, immediate and nearby delivery. On futures 23c. could have been shaded.

Pyridine—Spot holdings small and prices steady at $4.25@$4.35 per gal.

Solvent Naphtha—Good inquiry and prices firm on basis of 24c. per gal. on the water white, tank cars, works. Spot offerings small.

Toluene—There was a good call for toluene from lacquer makers and the market was firm in all directions, with little available for immediate delivery. Quotations repeated on the tank car basis of 26c. per gal., f.o.b. point of production.

Vegetable Oils and Fats

Lower Prices for Cottonseed, Linseed, Corn and China Wood Oils—Weakness Restricts Buying Movement

THE sharp break in grains brought out general liquidation in commodity markets and major items in the list of vegetable oils and fats closed lower. Inquiry from consumers fell away, buyers refusing to contract ahead while conditions were so unsettled. On the other hand producers did not appear anxious to force matters on the selling end, believing that fundamental conditions have changed but little in the past week. Lower prices were named for crude and refined cottonseed oil, linseed oil, china wood oil, soya bean oil, corn oil, palm oils and oleo stearine. Tallow was easy at the recent decline. Greases also were easy. Olive oil foots was one of the exceptions, holding steady on smaller offerings from abroad. It was reported that the linseed oil tariff case will be placed before the President late this month.

Cottonseed Oil—The decline in grains exerted considerable influence on the market and before the week came to a close prices for prime summer yellow oil went off from 28@29 points in the different positions. March oil settled on Wednesday at 10.85@10.87c. per lb., with May at 11.07@11.09c. per lb., Produce Exchange terms. Crude in the Southeast in tank cars was nominal at 9c. per lb., and in Texas the market was quoted at 8¾@8¾c. per lb., a decline of ¼c. for the week. Cash trade in oil was quiet, while reports on the state of the compound demand were not so favorable as a week ago. The fact that a heavy long interest, of a speculative character, exists in May oil tends to discourage business on the bull side. Refiners took in nearby oil on the decline. Offerings of crude oil were not large, most holders entertaining bullish views, notwithstanding the bearish statistical position of the commodity. The feeling still persists that the lard situation will more than offset the gain in actual production of oil. Pure lard in Chicago was from 35@37 points net lower, the May option closing at 16c. per lb. Lard compound was available here at 13c. per lb., in bbl., carload basis.

Linseed Oil—After opening firm, the market broke sharply, final prices being 7c. net lower. On Monday crushers raised the carload quotation for prompt and nearby oil to $1.21, but by Wednesday offerings were numerous at $1.15 per gal., cooperage basis. In fact it was intimated that some sellers stood ready to take on business as low as $1.12 per gal., carload basis. The decline was in sympathy with flaxseed, Duluth prices going off from 20@23c. per bu. in the course of the week. Flaxseed declines were attributed to liquidation on the part of the speculative element, who acted on the sharp break in wheat. Crushers did little one way or the other, sentiment in this direction being almost universally bullish on the unfavorable outlook for the Argentine crop. Buenos Aires quoted March seed at $2.45, which compares with $2.53½ per bu. a week ago. The Argentine market was easy in sympathy with the decline registered in the American northwest. The new crop has not been moving freely, owing to the fact that other grains have been receiving first consideration. Buying on the part of American and Continental crushers in the South American market has not been active. On Wednesday Duluth quoted February seed at $2.92 per bu., with May at $2.93½ per bu., and July at $2.90½ per bu. Export demand for linseed cake was dull and prices declined to $44 per ton, c.i.f. New York.

China Wood Oil—Selling pressure again was in evidence and business in scattered lots went through at lower prices. Pacific coast operators reported sales at 12½c. per lb., tank car basis, which compares with 13c. a week ago. In New York spot and nearby oil was offered at 14½@14½c. per lb., cooperage basis. Demand was quiet. Cables from the Orient were firm, despite weakness here.

Oilseed Shipments to U. S. in 1924 Smaller

Imports of copra, flaxseed and castor beans declined in 1924, compared with the preceding year. The slump in imports of copra was offset by larger receipts of coconut oil. The drop in imports of flaxseed was attributed to the gain in domestic production. Imports of oilseeds in 1924, with a comparison, follow:

	1924	1923
Castor beans, lb.	84,977,470	88,539,306
Copra, lb.	285,426,953	332,974,498
Imported from:		
Philippines	232,941,191	259,896,487
Australia	374,262	13,266,763
Br. Oceania	13,147,343	19,731,789
Fr. Oceania	22,161,526	27,148,775
Other Oceania	3,820,739	1,359,665
Other countries	12,981,892	11,571,019
Flaxseed, bu.	16,588,881	24,332,329
Imported from:		
Canada	2,749,988	3,007,680
Argentina	13,837,829	21,151,345
Other countries	1,064	173,304

Coconut Oil—Offerings of Manila oil were reported at 9⅜c. per lb., tank cars, February-March shipment, and at 9½c. per lb., tank cars, April forward shipment, f.o.b. Pacific coast ports. Demand was inactive and the undertone easy. Offerings of palm kernel oil from abroad at concessions had a depressing influence upon the trade. In New York Ceylon type oil on spot held around 9⅜c. per lb., tank car basis.

Corn Oil—Last sales went through at 9⅜c. per lb., tank cars, f.o.b. point of shipment in the Middle West, a decline of ¼c.

Olive Oil Foots—Market steady at 9½c. per lb., prime green Italian, prompt and forward shipment. Foreign markets firmer and distressed lots here cleaned up.

Palm Kernel Oil—There were offerings at 9¼@9⅜c. per lb., in casks, shipment from English or German ports.

Palm Oils—Lagos oil nominal at 9¼c. asked, with buyers' views considerably under this price. Niger oil offered for shipment from Africa at 8.40c. per lb., c.i.f. New York.

Sesame Oil—Sales took place at 12½c. per lb., in bbl., nearby delivery. Offerings from abroad increased.

Soya Bean Oil—Crude oil available at 11c. per lb., tank cars, duty paid, nearby shipment from the Pacific coast.

Tallow, Etc.—Business in extra special tallow officially reported at 9c. per lb., f.o.b. plant. The undertone was easy. Yellow grease nominal at 8¼c. per lb. Oleo stearine sold at 10¼c. per lb., a decline of ¼c. No. 1 oleo oil nominal at 12c. per lb., in bbl.

Chem. & Met. Weighted Index of Prices for Oils and Fats

Base = 100 for 1913-14

This week	148.33
Last week	153.04
Feb., 1924	141.05
Feb., 1923	131.71

Weakness in speculative commodity markets influenced prices for vegetable oils and animal fats. Lower prices prevailed for cottonseed, linseed, crude corn, china wood, oleo stearine, oleo oil and dynamite glycerine. The weighted index number declined 4.71 points. Trading was quiet.

Miscellaneous Materials

Antimony—Market strong on small stocks and good inquiry. Chinese brands advanced to 20c. per lb. Cookson's "C" grade nominal at 22c. per lb. Chinese needle, lump, 10@10½c. per lb. Standard powdered, needle, 200 mesh, 11½@13c. per lb. Antimony oxide firm at 16@17c. per lb.

Glycerine—Dynamite sold at 18¼c. per lb., in drums, carload lots, f.o.b. point of production, a decline of ¼c. Chemically pure was nominally unchanged at 19c. per lb., but the undertone was barely steady, especially in the Middle West. Soap-lye crude offered at 12½c. per lb., loose, carload lots, ex plant.

Lithopone—Less inclination on the part of producers to force business and the market appears to be in a firmer position. There has been a normal volume of new business. Leading factors quote 6@6½c. per lb., in bags, carload lots, immediate and nearby delivery.

Shellac—Imports of shellac in 1924 amounted to 24,552,998 lb., which compares with 38,446,775 lb. in 1923, according to official statistics. The market in the past week was steady on the basis of 62c. per lb. for T.N. shellac. Consumers not inclined to anticipate in their wants.

Lead Pigments—With no important change in the position of the metal corroders reported the market on all of the pigments as steady to firm. Pig lead held at 9½c. per lb. in the New York trade. Standard dry white lead was quoted at 11½c. per lb.

Imports at the Port of New York

February 6 to February 11

ACIDS — Cresylic — 30 dr., Glasgow, United American Lines; 46 dr., Hamburg, Lehn & Fink. **Formic**—79 pkg., Rotterdam, E. Suter & Co. **Lactic**—15 bbl., Hamburg, Order. **Stearic**—20 cs., Rotterdam, M. W. Parsons & Plymouth Organic Lab.; 2 bg., Rotterdam, Lamont, Corliss Co. **Tartaric**—325 kegs, Antwerp, W. Benkert & Co.; 125 kegs, Genoa, Superfos Co.; 160 csk., Marseilles, Brown Bros. & Co.; 340 kegs and 105 bbl., Rotterdam, W. Neuberg.

ALCOHOL — 100 bbl. denatured, San Juan, C. Estevas; 59 bbl. do, San Juan, Olivett Distilling Co.; 100 bbl. do, Arecibo, Order.

ANTIMONY SULPHURET — 35 csk., Havre, American Express Co.; 2 bg., London, L. H. Butcher & Co.

ANTIMONY REGULUS—250 cs., Hamburg, Order.

ARSENIC — 300 bbl. white, Hamburg, Chemical National Bank; 50 csk., Hamburg, A. Klipstein & Co.

BARIUM CARBONATE—500 bg., Hamburg, Order.

BARIUM CHLORIDE — 46 bbl., Hamburg, A. Klipstein & Co.; 60 csk., Rotterdam. Goldschmidt Corp.

BARYTES—300 bg., Bremen, New York Trust Co.; 138 csk., London, Toch Bros.

BLEACHING POWDER—50 cs., Liverpool, H. Kohnstamm & Co.

BRIMSTONE—5 csk., London, McKesson & Robbins.

CALCUIM CHLORIDE — 102 dr., Antwerp, E. Suter & Co.

CALCUIM CARBONATE—4 csk., Hamburg, Diener, Blank & Co.

CAMPHOR — 100 cs., Hamburg, Equitable Trust Co.

CASEIN—417 bg., Buenos Aires, West Virginia Pulp & Paper Co.; 2,168 bg., Buenos Aires, National City Bank.

CHALK—500 bg., Havre, Solomon Bros.; 2,000 bg., Havre, Scott, Libby Co.; 550,000 kilos, Dunkirk, Taintor Trading Co.; 400 bg., Bristol, H. J. Baker & Bro.; 500 bg., Antwerp, Reichard, Coulston, Inc.; 800 tons crude, London, Baring Bros. & Co.

CHEMICALS—28 csk., Glasgow, Frazer & Co.; 274 bg., Glasgow, Brown Bros. & Co.; 1,200 cs., Hamburg, Roessler & Hasslacher Chemical Co.; 100 bg. and 67 csk., Hamburg, Jungmann & Co.; 41 csk., Bremen, Mechanics & Metals National Bank; 45 bbl., Bremen, Stanley Daggett, Inc., 125 bg. and 39 csk., Hamburg, Mechanics & Metals National Bank; 200 csk., Rotterdam, Hans Hinrichs Chem. Co.; 120 csk., Rotterdam, Roessler & Hasslacher Chem. Co.

CHINA CLAY—784 tons, Bristol, Moore & Munger; 50 tons, Bristol, United Clay Products Co.; 228 bg., Bristol, Order.

COAL-TAR DISTILLATE — 100 dr., Liverpool, Order.

COLORS—20 csk., Southampton, Brown Bros. & Co.; 6 csk. aniline, Hamburg, Franklin Import & Export Co.; 1 csk. do, Hamburg, H. A. Metz & Co.; 20 cs. bronze, Hamburg, M. J. Corbett & Co.; 15 csk., Bremen, Fuchs & Lang; 17 bbl. aniline, Genoa, Irving Bank-Col. Trust Co.; 42 dr. aniline and 70 kegs do, Rotterdam, Ciba Co.; 23 csk. do, Rotterdam, H. A. Metz & Co.; 45 pkg. do, Rotterdam. Kuttroff, Pickhardt & Co.

COPPER OXIDE — 30 dr., Hamburg, Order.

FERROTITANIUM — 9 kegs, Liverpool, Order.

FULLERS EARTH — 250 bg., Bristol, L. A. Salomon & Bro.; 300 bg., London, L. A. Salomon & Bro.

GRAPHITE—516 bg., Marseilles, Bank of the Manhattan Co.; 259 bg., Marseilles, National City Bank.

GUMS—234 bg. copal, Antwerp, Equitable Trust Co.; 1,718 bg. copal, Matadi, L. C. Gillespie & Sons.

HYDROGEN PEROXIDE — 24 carboys, London, Order; 10 carboys, London, H. Sundhelmer, Inc.

IRON OXIDE—320 bg., Bristol, G. Z. Collins & Co.; 95 csk., Bristol, Reichard-Coulston, Inc.; 28 csk., Bristol, Order; 8 csk., Antwerp, Reichard-Coulston, Inc.; 228 bbl., Malaga, W. S. Schall & Co.; 46 bbl., Malaga, Hummel & Robinson Corp.; 190 bbl., Malaga, C. K. Williams & Co.; 100 bbl., Malaga, Reichard-Coulston, Inc.; 120 bbl. and 100 bg., Malaga, J. Lee Smith & Co.; 79 bbl., Malaga, Smith Chemical & Color Co.; 100 bbl., Malaga, Order; 56 csk., Liverpool, J. Lee Smith & Co.; 31 csk., Liverpool, L. H. Butcher & Co.; 15 csk., Liverpool, J. A. McNulty.

LAMPBLACK — 200 csk., Antwerp, F. Van Geisten.

LOGWOOD EXTRACT—105 bbl., Cape Haitian, Longwood Mfg. Corp.

Opportunities in the Foreign Trade

Parties interested in any of the following opportunities may obtain all available information from the Bureau of Foreign and Domestic Commerce at Washington or from any district office of the bureau. The number placed after the opportunity must be given for the purpose of identification.

ALCOHOL, denatured. Alexandria, Egypt. Purchase.—13,610.

BARIUM CHLORIDE, sulphate, aluminum sulphate, rosin, and rosin oil. Sao Paulo, Brazil. Purchase.—13,589.

CHEMICAL PRODUCTS. Milan, Italy. Agency.—13,630.

CHEMICALS, heavy; fertilizers, insecticides. Sao Paulo, Brazil. Agency.—13,589.

FERTILIZERS and fertilizer materials. Malaga, Spain. Agency.—13,599.

GLUE, leather. Bordeaux, France. Purchase.—13,541.

MATCHES. Alexandria, Egyp. Agency.—13,600.

NAVAL STORES. Hamburg, Germany. Agency.—13,594.

PIGMENTS. Para, Brazil. Purchase.—13,591.

SODIUM BICARBONATE for tanneries. Bordeaux, France. Agency.—13,625.

SODA CAUSTIC. Para, Brazil. Agency.—13,593.

LITHOPONE — 20 csk., Rotterdam, Reichard-Coulston, Inc.; 40 csk., Rotterdam, L. H. Butcher & Co.

MAGNESITE — 313 bg., Rotterdam, Speiden, Whitfield & Co.

MAGNESIUM CHLORIDE — 180 dr., Hamburg, Innis, Speiden & Co.; 179 dr., Hamburg, Order.

NICKEL SULPHATE — 23 csk., Liverpool, Philipp Bros.

OCHER — 100 csk., Marseilles, J. Lee Smith & Co.; 50 csk., Marseilles, E. E. Marks Co.; 53 csk., Marseilles, E. M. & F. Waldo, Inc.; 537 csk., Marseilles, Reichard-Coulston, Inc.

OILS — Coconut — 1,901,470 lb., Manila, Procter & Gamble Co. **Cod**—160 csk., St. Johns, R. Badcock & Co. **Cottonseed**—18 dr., San Juan, Porto Rican Products Co. **Olive foots** (sulphur oil)—200 bbl, Patras, Order; 200 bbl., Catania, National City Bank. **Palm kernel** — 27 bbl., Hamburg, Order; 109 csk., Hamburg Order. **Palm**—100 csk., Hamburg, African & Eastern Trading Co.; 61 csk., Hamburg, Order; 3167 csk., Matadi, Niger Co.; 38 csk., Liverpool, Order. **Sesame**—200 bbl., Rotterdam, Order.

OILSEEDS — Copra — 132 pkg., Morant Bay, Franklin Baker Co. **Linseed**—34,837 bg. and 815,896 kilos, Rosario, Order; 58,800 bg. and 2,160,986 kilos (in bulk), Buenos Aires and Rosario, Order. **Rapeseed**—491 bg., Buenos Aires, Equitable Trust Co.

PLUMBAGO—100 bbl., Colombo, Order; 79 bbl., Colombo, Order.

POTASSIUM SALTS—32 csk. carbonate, Hamburg, Brown Bros. & Co.; 253 dr. caustic, Hamburg, Roessler & Hasslacher Chemical Co.; 160 bg. sulphate, 182,034 kilos manure salts and 92,864 kilos kainit, Hamburg, Potash Importing Corp. of America; 1,500 csk. chloride, Hamburg, Irving Bank-Col. Trust Co.; 25 cs. bromide, Hamburg, H. W. Peabody & Co.; 426 dr. caustic, Hamburg, A. Klipstein & Co.; 50 bbl. caustic, Hamburg, Hummel & Robinson; 82 dr. caustic, Hamburg, Order; 72 cs. bromide, Hamburg, Order; 227 bbl. alum and 1,000 bg. muriate, Hamburg, Order; 60 bbl. prussiate, Antwerp, E. Suter & Co.; 50 csk. alum, Hamburg, Pacific Chemical Co.

PUMICE — 4,579 bg., Canneto Lipari, R. J. Waddell & Co.; 524 bg., Canneto Lipari, Whittaker, Clark & Daniels.

PYRIDINE — 4 dr., Hamburg, R. W. Greeff & Co.; 3 dr., Hamburg, Order.

QUEBRACHO—3,070 bg., Buenos Aires, Order; 555 bg., Buenos Aires, Order.

QUICKSILVER—50 flasks, London, A. H. Pickering; 160 flasks, Leghorn, Order.

SAL AMMONIAC — 80 csk., Hamburg, Order; 150 csk., Bristol, C. de P. Field Co.

SHELLAC — 110 bg., Calcutta, Brown Bros. & Co.; 200 bg., Calcutta, Brunswick-Balke-Collender Co.; 625 bg., Calcutta, Order; 35 cs., Marseilles, Jawitz & Sons; 213 cs., Marseilles, Order; 170 bg., Calcutta, Marx & Rawolle; 200 bg., Calcutta, Bank of London & South America; 300 bg., Calcutta, Brunswick-Balke-Collender Co.; 43 cs., Rotterdam, C. F. Gerlach.

SIENNA — 20 csk., Leghorn, L. H. Butcher & Co.; 25 csk, Leghorn, J. Lee Smith & Co.

SODIUM SALTS — 41,952 bg. nitrate Iquique, Wessel, Duval & Co.; 1902 bg. do, Iquique, E. I. du Pont de Nemours Co.; 154 pkg. cyanide, Havre, Anglo-South American Trust Co.; 220 dr. sulphite, Hamburg, C. S. Grant & Co.; 118 csk. and 1,880 bg. nitrate, Hamburg, Kuttroff, Pickhardt & Co.; 5 cs. caustic, Liverpool, H. Kohnstamm & Co.; 184 dr. cyanide, Liverpool, Order; 132 dr. sulphate, Rotterdam, C. S. Grant & Co.; 66 dr. hydrosulphite, Rotterdam, Kuttroff, Pickhardt & Co.; 14 csk. prussiate, Rotterdam, C. Tennant Sons. & Co.; 110 csk. fluosilicate, Rotterdam, Order; 92 csk. prussiate, Rotterdam, Order.

STRONTIUM NITRATE — 73 csk., Rotterdam, Pfaltz & Bauer.

SUMAC—771 bg. ground, Palermo, J. S. Young & Co.; 140 bg., Palermo, Order.

TALC—200 bg., Bordeaux, E. M. & F. Waldo; 200 bg., Bordeaux, A. Klipstein & Co.; 500 bg., Bordeaux, L. A. Salomon & Bro.

TARTAR—300 bg., Marseilles, C. Pfizer & Co.; 410 bg., Marseilles, Royal Baking Powder Co.

VALONEA — 1,265 bg., Smyrna, Order; 415 bg., Smyrna, Order; 7,175 bg., Constantinople, Order; 3,482 bg., Smyrna, A. Benadava; 4,108 bg., Smyrna, Order.

WAXES — 50 cs. spermaceti, Glasgow, Smith & Nichols; 1,500 bg. montan, Hamburg, Strohmeyer & Arpe; 20 bg. beeswax, Leghorn, Order; 10 bg. beeswax, Genoa, Order; 55 bg. carnauba, Liverpool, National City Bank.

WHITING — 5,640 bg., Havre, Taintor Trading Co.

WOOL GREASE — 65 bbl., Manchester, American Trust Co.

ZINC OXIDE—50 csk., Rotterdam, L. H. Butcher & Co.

Current Prices in the New York Market

For Chemicals, Oils and Allied Products

THESE prices are first-hand quotations in the New York market for industrial chemicals, coal-tar products and related materials used in the industries that produce

Dyes	**Paper and Pulp**
Paint and Varnish	**Petroleum**
Ceramic Materials	**Soap**
Fertilizers	**Explosives**
Rubber	**Food Products**
Sugar	**Metal Products**

Whenever available these prices are those of the American manufacturer. If for material f.o.b. works or on a contract basis, quotations are so designated. All prices refer to large quantities in original packages.

Industrial Chemicals

Acetone, drums, works	lb.	$0.10 –	$0.11
Acetic anhydride, 85 %, dr.	lb.	.36 –	.38
Acid, acetic, 28%, bbl.	100 lb.	3.12 –	3.37
Acetic, 56%, bbl.	100 lb.	5.85 –	6.10
Acetic, 80%, bbl.	100 lb.	8.19 –	8.44
Glacial, 99½%, bbl.	100 lb.	11.01 –	11.51
Boric, bbl.	lb.	.10½–	.10½
Citric, kegs	lb.	.46 –	.46½
Formic, 85%	lb.	.10½–	.10½
Gallic, tech.	lb.	.45½–	.47
Hydrofluoric, 52%, carboys	lb.	.11 –	.12
Lactic, 44%, tech., light, bbl.	lb.	.13½–	.14
22% tech., light, bbl.	lb.	.06½–	.07
Muriatic, 18° tanks	100 lb.	.80 –	.85
Muriatic, 20°, tanks	100 lb.	.95 –	1.00
Nitric, 36°, carboys	lb.	.04 –	.04½
Nitric, 42°, carboys	lb.	.04½–	.05½
Oleum, 20%, tanks	ton	16.00 –	17.00
Oxalic, crystals, bbl.	lb.	.10½–	.11
Phosphoric, 50% carboys	lb.	.07½–	.07½
Pyrogallic, resublimed	lb.	1.55 –	1.60
Sulphuric, 60°, tanks	ton	8.50 –	9.50
Sulphuric, 60°, drums	ton	12.50 –	13.50
Sulphuric, 66°, tanks	ton	13.50 –	14.50
Sulphuric, 66°, drums	ton	17.50 –	18.50
Tannic, U.S.P., bbl.	lb.	.65 –	.70
Tannic, tech., bbl	lb.	.45 –	.50
Tartaric, imp., powd., bbl.	lb.	.27½–	.28
Tartaric, domestic, bbl.	lb.	.29 –	.30
Tungstic, per lb.	lb.	1.20 –	1.25
Alcohol, butyl, drums, wks.	lb.	.27 –	.30
Ethyl, 190 p'f. U.S.P., bbl.	gal.	4.89 –	.....
Denatured, 190 proof No. 1, special bbl.	gal.	.61 –	.....
No. 1, 190 proof, special, dr.	gal.	.55 –	.....
No. 1, 188 proof, bbl.	gal.	.65 –	.....
No. 1, 188 proof, dr.	gal.	.58 –	.....
No. 5, 188 proof, bbl.	gal.	.60 –	.....
No. 5, 188 proof, dr.	gal.	.54 –	.....
Alum, ammonia, lump, bbl.	lb.	.03½–	.04
Potash, lump, bbl.	lb.	.03½–	.03¾
Chrome, lump, potash, bbl.	lb.	.05½–	.06
Aluminum sulphate, com., bags	100 lb.	1.40 –	1.45
Iron free, bags	lb.	2.00 –	2.10
Aqua ammonia, 26°, drums	lb.	.06½–	.06¾
Ammonia, anhydrous, cyl.	lb.	.28 –	.30
Ammonium carbonate, powd., tech., casks	lb.	.12 –	.12½
Nitrate, tech., casks	lb.	.09 –	.10
Amyl acetate tech., drums	gal.	3.25 –	3.50
Antimony oxide, white, bbl.	lb.	.16 –	.16½
Arsenic, white, powd., bbl.	lb.	.05½–	.05¾
Red, powd., kegs	lb.	.14½–	.15½
Barium carbonate, bbl.	ton	53.00 –	54.00
Chloride, bbl.	ton	66.00 –	68.00
Dioxide, 88%, drums	lb.	.17½–	.18
Nitrate, casks		.07½–	.08
Blanc fixe, dry, bbl.	lb.	.03½–	.03¾
Bleaching powder, f.o.b. wks., drums, contract	100 lb.	1.90 –	.....
Spot, wks., drums	100 lb.	2.00 –	2.15
Borax, bbl.	lb.	.05 –	.05½
Bromine, cases	lb.	.47 –	.48
Calcium acetate, bags	100 lb.	3.00 –	3.05
Arsenate, dr.	lb.	.08 –	.08½
Carbide, drums	lb.	.05 –	.05½
Chloride, fused, dr. wks.	ton	21.00 –	.....
Gran. drums works	ton	27.00 –	.....
Phosphate, mono, bbl.	lb.	.06½–	.07½
Carbon bisulphide, drums	lb.	.06 –	.06½
Tetrachloride, drums	lb.	.07 –	.07½
Chalk, precip.—domestic, light, bbl.	lb.	.04½–	.04¾
Imported, light, bbl.	lb.	.04½–	.05
Chlorine, liquid, tanks, wks.	lb.	.04½–	.....
Contract, tanks, wks.	lb.	.04 –	.....
Cylinders, 100 lb., wks.	lb.	.05½–	.07½
Cobalt, oxide, bbl.	lb.	2.10 –	2.25
Copperas, bulk, f.o.b. wks.	ton	16.00 –	18.00
Copper carbonate, bbl.	lb.	.17½–	17½
Cyanide, drums	lb.	.49 –	.50
Oxide, kegs	lb.	.16½–	.16¾
Sulphate, dom., bbl.	100 lb.	4.75 –	4.80
Imp. bbl.	100 lb.	4.62½–	.....
Cream of tartar, bbl.	lb.	.21 –	.21½
Epsom salt, dom., bbl.	100 lb.	1.75 –	2.00
Imp., tech., bags	100 lb.	1.35 –	1.40
U.S.P., dom., bbl.	100 lb.	2.10 –	2.35
Ether, U.S.P., dr concent'd.	lb.	.15 –	.16
Ethyl acetate, 85%, drums	gal.	.92 –	.95
Acetate, 99%, dr.	gal.	1.08 –	1.10
Formaldehyde, 40%, bbl.	lb.	.09 –	.09½
Fullers earth—f.o.b. mines	ton	7.50 –	18.00
Furfural, works, bbl.	lb.	.23 –	.....
Fusel oil, ref., drums	gal.	3.50 –	4.00
Crude, drums	gal.	2.60 –	2.80
Glaubers salt, wks., bags	100 lb.	1.15 –	1.40
Imp., bags	100 lb.	.85	.95
Glycerine, c. p., drums extra	lb.	.19 –	.19½
Crude 80%, loose	lb.	.12½–	.12¾
Hexamethylene, drums	lb.	.65 –	.67
Lead:			
White basic carbonate, dry, casks	lb.	$0.11½–	.....
White, basic sulphate, casks	lb.	.11 –	.....
White, in oil, kegs	lb.	.1297–	.....
Red, dry, casks	lb.	.1325–	.....
Red, in oil, kegs	lb.	.1428–	.....
Acetate, white crys., bbl.	lb.	.15½–	.....
Brown, broken, casks	lb.	.14½–	.....
Arsenate, powdered, bbl.	lb.	.15 –	$0.16
Lime-Hydrated, b.g., wks.	ton	10.50 –	12.50
Bbl., wks.	ton	18.00 –	19.00
Lump, bbl.	280 lb.	3.63 –	3.65
Litharge, comm., casks	lb.	.12½–	.....
Lithopone, bags	lb.	.06 –	.06½
Magnesium carb., tech., bags	lb.	.07 –	.08
Methanol, 95%, drums	gal.	.70 –	.72
97%, drums	gal.	.72 –	.74
Pure, tanks	gal.	.74 –	.76
drums	gal.	.78 –	.80
bbl.	gal.	.83 –	.85
Methyl-acetone, t'ks.	gal.	.70 –	.....
Nickel salt, double, bbl.	lb.	.10 –	.....
Single, bbl.	lb.	.10½–	.....
Orange mineral, cak.	lb.	.16½–	.16½
Phosgene		.60 –	.75
Phosphorus, red, cases	lb.	.70 –	.75
Yellow, cases	lb.	.37½–	.40
Potassium bichromate, casks	lb.	.08½–	.08¾
Bromide, gran., bbl.	lb.	.40 –	.48
Carbonate, 80–85%, calcined, casks	lb.	.06 –	.06½
Chlorate, powd.	lb.	.07 –	.08½
Cyanide, drums	lb.	.47 –	.52
First sorts, cask	lb.	.08½–	.08¾
Hydroxide (caustic potash) drums	lb.	.07½–	.07½
Iodide, cases	lb.	3.65 –	3.75
Nitrate, bbl.	lb.	.06 –	.07½
Permanganate, drums	lb.	.14½–	.14¾
Prussiate, red, casks	lb.	.38 –	.38½
Prussiate, yellow, casks	lb.	.18 –	.18½
Salammoniac, white, gran., casks, imported	lb.	.05½–	.06
White, gran., bbl., domestic	lb.	.07 –	.07½
Gray, gran., casks	lb.	.08 –	.09
Salsoda, bbl.	100 lb.	1.20 –	1.40
Salt cake (bulk) works	ton	17.00 –	19.00
Soda ash, light 58% flat, bulk, contract	100 lb.	1.25 –	.....
bags, contract	100 lb.	1.38 –	.....
Dense, bulk, contract, basis 58%	100 lb.	1.35 –	.....
bags, contract	100 lb.	1.45 –	.....
Soda, caustic, 76%, solid, drums contract	100 lb.	3.10 –	.....
Caustic, ground and flake, contracts, dr.	100 lb.	3.50 –	3.85
Caustic, solid, 76% f.a.s. N. Y.	100 lb.	2.80 –	3.05
Sodium acetate, works, bbl.	lb.	.05 –	.05½
Bicarbonate, bulk	100 lb.	1.75 –	.....
Bichromate, casks	lb.	.06½–	.06¾
Bisulphate (niter cake)	ton	6.00 –	7.00
Bisulphite, powd., U.S.P., bbl.	lb.	.04½–	.04½
Bromide, bbl.	lb.	.41 –	.47
Chlorate, kegs	lb.	.06½–	.06¾
Chloride	long ton	12.00 –	13.00
Cyanide, cases	lb.	.19 –	.22
Flouride, bbl.	lb.	.09 –	.09½
Hyposulphite, bbl.	lb.	.02½–	.02¾
Nitrite, casks	lb.	.09 –	.09½
Peroxide, powd., cases	lb.	.23 –	.27
Phosphate, dibasic, bbl.	lb.	.03½–	.03¾
Prussiate, yel. bbl.	lb.	.10½–	.10¾
Salicylate, drums	lb.	$0.38 –	$0.40
Silicate (40°, drums)	100 lb.	.75 –	1.16
Silicate (60°, drums)	100 lb.	1.75 –	2.00
Sulphide, fused, 60-62%, drums	lb.	.02½–	.03½
Sulphite, crys., bbl.	lb.	.03½–	.03½
Strontium nitrate, powd., bbl	lb.	.09½–	.10
Sulphur chloride, yel drums	lb.	.04½–	.05
Crude	ton	18.00 –	19.00
At mine, bulk	ton	14.00 –	16.00
Flour, bag	100 lb.	2.25 –	2.35
Dioxide, liquid, cyl.	lb.	.08 –	.08½
Tin bichloride, bbl.	lb.	.16 –	.....
Oxide, bbl.	lb.	.61 –	.....
Crystals, bbl.	lb.	.39½–	.40
Zinc carbonate, bags	lb.	.12 –	.14
Chloride, gran., bags	lb.	.06½–	.07½
Cyanide, drums	lb.	.40 –	.41
Dust bbl.	lb.	.08 –	.08½
Oxide, lead free, bags	lb.	.07½–	.....
5% lead sulphate bags	lb.	.06½–	.....
French, red seal, bags	lb.	.09½–	.....
French, green seal, bags	lb.	.10½–	.....
French, white seal, bbl.	lb.	.11½–	.....
Sulphate, bbl.	100 lb.	3.00 –	3.50

Coal-Tar Products

Alpha-naphthol, crude, bbl.	lb.	$0.60 –	$0.62
Alpha-naphthol, ref., bbl.	lb.	.80 –	.85
Alpha-naphthylamine, bbl.	lb.	.35 –	.36
Aniline oil, drums	lb.	.16 –	.16½
Aniline salt, bbl.	lb.	.22 –	.23
Anthracene, 80%, drums	lb.	.65 –	.70
Anthraquinone, 25%, drums	lb.	.65 –	.67
Benzaldehyde U.S.P., tech., drums	lb.	.69 –	.71
Benzene, pure, tanks, works	gal.	.23 –	.....
Benzene, 90%, tanks, works	gal.	.21 –	.....
Benzidine base, bbl.	lb.	.75 –	.78
Benzyl chloride, ref. carboys	lb.	.35 –	.....
Benzyl chloride, tech., drums	lb.	.25 –	.....
Beta-naphthol, tech., bbl.	lb.	.24 –	.25
Beta-naphthylamine, tech.	lb.	.65 –	.70
Cresylic acid, 97%, drums	gal.	.59 –	.62
95-97%, drums, works	gal.	.55 –	.57
Dichlorbenzene, drums	lb.	.07 –	.08½
Dinitrobenzene, bbl.	lb.	.15 –	.16
Dinitrochlorbenzene, bbl.	lb.	.20 –	.21
Dinitrophenol, bbl.	lb.	.35 –	.40
Dinitrotoluen, bbl.	lb.	.18 –	.20
Dip oil, 25%, drums	gal.	.26 –	.28
H-acid, bbl.	lb.	.70 –	.74
Meta-phenylenediamine, bbl.	lb.	.90 –	.95
Monochlorbenzene, drums	lb.	.08½–	.10
Naphthalene, flake, bbl.	lb.	.05 –	.05½
Naphthionate of soda, bbl.	lb.	.60 –	.65
Naphthionic acid, crude, bbl.	lb.	.60 –	.62
Nitrobenzene, drums	lb.	.09 –	.09½
Nitro-naphthalene, bbl.	lb.	.25 –	.27
Nitro-toluene, drums	lb.	.13½–	.14
N-W acid, bbl	lb.	1.05 –	1.10
Ortho-amidophenol, kegs	lb.	2.40 –	2.50
Ortho-dichlorbenzene, drums	lb.	.10 –	.11
Ortho-toluidine, bbl.	lb.	.18 –	.19
Para-aminophenol, base, kegs	lb.	1.15 –	1.20
Para-dichlorbenzene, bbl.	lb.	.18 –	.19
Para-nitraniline, bbl.	lb.	.62 –	.68
Para-nitrotoluene, bbl.	lb.	.40 –	.42
Para-phenylendiamine, bbl.	lb.	1.25 –	1.35
Para-toluidine, bbl.	lb.	.70 –	.75
Phenol, U.S.P., dr.	lb.	.23 –	.25
Picric acid, bbl.	lb.	.25 –	.26
Pitch, tanks, works	ton	27.00 –	30.00
Pyridine, imp., drums	gal.	4.25 –	4.35
Resorcinol, tech., kegs	lb.	1.30 –	1.40
Resorcinol, pure, kegs	lb.	2.00 –	2.25
R-salt, bbl.	lb.	.46 –	.48
Salicylic acid, tech., bbl.	lb.	.34 –	.36
Salicylic acid, U.S.P., bbl.	lb.	.35 –	.....
Solvent naphtha, water-white, tanks	gal.	.24 –	.25
Crude, tanks	gal.	.21 –	.22
Sulphanilic acid, crude, bbl.	lb.	.16 –	.18
Tolidine, bbl.	lb.	1.00 –	1.05
Toluidine, mixed, kegs	lb.	.30 –	.35
Toluene, tank cars, works	gal.	.26 –	.....
Toluene, drums, works	gal.	.31 –	.....
Xylidine, drums	lb.	.40 –	.42
Xylene, 5 deg.-tanks	gal.	.34 –	.36
Xylene, com., tanks	gal.	.24 –	.26

Naval Stores

Rosin B-D, bbl.	280 lb.	$8.40 –	$8.45
Rosin E-I, bbl.	280 lb.	8.45 –	8.50
Rosin K-N, bbl.	280 lb.	8.70 –	8.80
Rosin W.G.-W.W., bbl.	280 lb.	9.60 –	10.50
Turpentine, spirits of, bbl.	gal.	.94 –	.....
Wood, steam dist., bbl.	gal.	.82 –	.82½
Wood, dest. dist., bbl.	gal.	.72 –	.73
Pine tar pitch, bbl.	200 lb.	6.00 –	.....
Tar, kiln burned, bbl.	500 lb.	13.00 –	13.50
Rosin oil, first run, bbl.	gal.	.47 –	.48
Pine tar oil, com'l.	gal.	.32 –	.....

Animal Oils and Fats

Degras, bbl.	lb.	$0.03½ –	$0.05½
Grease, yellow, loose	lb.	.08½ –	.08¾
Lard oil, Extra No. 1, bbl.	gal.	.96 –	.98½
Lard compound, bbl.	lb.	.13 –	.13½
Neatsfootoil, 20 deg. bbl.	gal.	1.35 –	1.37
Oleo Stearine		.10½ –	
Oleo oil, No. 1, bbl.	lb.	.12 –	.12½
Red oil, distilled, d.p. bbl.	lb.	.11 –	.11½
Tallow, extra, loose works	lb.	.09 –	.09½
Tallow oil, acidless, bbl.	gal.	.92 –	.94

Vegetable Oils

Castor oil, No. 3, bbl.	lb.	$0.17 –	$0.17½
Castor oil, No. 1, bbl.	lb.	.17½ –	.17½
Chinawood oil, bbl.	lb.	.14½ –	.14½
Coconut oil, Ceylon, bbl.	lb.	.10½ –	.11
Ceylon, tanks, N. Y.	lb.	.09½ –	.09¾
Corn oil, crude, bbl.	lb.	.11½ –	.12
Crude, tanks, (f.o.b. mill)	lb.	.09½ –	.10
Cottonseed oil, crude (f.o.b. mill), tanks	lb.	.08¾ –	.09
Summer yellow, bbl.	lb.	.11 –	.11½
Linseed oil, raw, car lots, bbl.	gal.	1.15 –	
Raw, tank cars (dom.)	gal.	1.09 –	
Boiled, cars, bbl. (dom.)	gal.	1.17 –	
Olive oil, denatured, bbl.	gal.	1.18 –	1.22
Sulphur, (foots) bbl.	lb.	.09½ –	.09½
Palm, Lagos, casks	lb.	.09½ –	
Niger, casks	lb.	.08½ –	
Palm kernel, bbl.	lb.	.09½ –	
Peanut oil, crude, tanks (mill)	lb.	.11 –	.11½
Refined, bbl.	lb.	.15½ –	.16
Perilla, bbl.	lb.	.14½ –	.14½
Rapeseed oil, refined, bbl.	gal.	.90 –	.91
Sesame, bbl.	lb.	.14½ –	.14½
Soya bean (Manchurian), bbl	lb.	.12½ –	
Tank, f.o.b. Pacific Coast	lb.	.11 –	.11½

Fish Oils

Cod, Newfoundland, bbl.	gal.	$0.62 –	$0.63
Menhaden, light pressed, bbl.	gal.	.72 –	.75
White bleached, bbl.	gal.	.74 –	.77
Crude, tanks (f.o.b. factory)	gal.	.55 –	
Whale No. 1 crude, tanks, coast	lb.	–	
Winter, natural, bbl.	gal.	.75 –	.76
Winter, bleached, bbl.	gal.	.78 –	

Dye & Tanning Materials

Albumen, blood, bbl.	lb.	$0.50 –	$0.55
Albumen, egg, tech, kegs	lb.	.90 –	.95
Cochineal, bags	lb.	.33 –	.35
Cutch, Borneo, bales	lb.	.04½ –	.05
Rangoon, bales	lb.	.13 –	.13½
Dextrine, corn, bags	100 lb.	4.72 –	4.77
Gum, bags	100 lb.	4.94 –	5.07
Divi-divi, bags	ton	48.00 –	50.00
Fustic, sticks	ton	30.00 –	35.00
Chips, bags	lb.	.04 –	.05
Gambier com., bags	lb.	.17½ –	.18
Logwood, sticks	ton	25.00 –	26.00
Chips, bags	lb.	.02½ –	.03
Sumac, leaves, Sicily, bags	ton	175.00 –	180.00
Domestic, bags	ton	50.00 –	55.00
Starch, corn, bags	100 lb.	3.97 –	4.24

Extracts

Archil, conc., bbl.	lb.	$0.16 –	$0.19
Chestnut, 25% tannin, tanks	lb.	.01½ –	.02½
Divi-divi, 25% tannin, bbl.	lb.	.05 –	.05
Fustic, liquid, 42°, bbl.	lb.	.08 –	.09½
Gambier, liq., 25% tannin, bbl.	lb.	.13½ –	.14
Hematine crys., bbl.	lb.	.14 –	.18
Hemlock, 25% tannin, bbl.	lb.	.03½ –	.04
Hypernic, liquid, 51°, bbl.	lb.	.12 –	.13
Logwood, crys., bbl.	lb.	.14 –	.15
Liq., 51°, bbl.	lb.	.07½ –	.08½
Osage Orange, 51°, liquid, bbl.	lb.	.07 –	.08
Quebracho, solid, 65% tannin, bbl.	lb.	.04½ –	.04¾
Sumac, dom., 51°, bbl.	lb.	.06½ –	.06¾

Dry Colors

Blacks–Carbongas, bags, f.o.b. works, contract	lb.	$0.06½ –	$0.08½
spot, bags	lb.	.08½ –	.12
Lampblack, bbl.	lb.	.12 –	.40
Mineral, bulk	ton	35.00 –	45.00
Blues–Prussian, bbl.	lb.	.35 –	.37
Ultramarine, bbl.	lb.	.08 –	.35
Browns, Sienna, Ital., bbl.	lb.	.05 –	.12
Sienna, Domestic, bbl.	lb.	.03 –	.03½
Umber, Turkey, bbl.	lb.	.04 –	.04½
Greens-Chrome, C.P.Light, bbl.	lb.	.30 –	.32
Chrome, commercial, bbl.	lb.	.11 –	.12
Paris, bulk	lb.	.21 –	.24
Reds, Carmine No. 40, tins	lb.	4.25 –	4.50
Iron oxide red, casks	lb.	.08 –	.12
Para toner, kegs	lb.	.95 –	1.00
Vermilion, English, bbl.	lb.	1.40 –	1.45
Yellow, Chrome, C.P. bbls.	lb.	.19½ –	.20½
Ocher, French, casks	lb.	.02 –	.03

Waxes

Beeswax, crude, Afr. bg.	lb.	$0.38½ –	$0.39
Refined, light, bags	lb.	.52 –	.53
Candellila, bags	lb.	.29 –	.30
Carnauba, No. 1, bags	lb.	.36 –	.37
No. 2, North Country, bags	lb.	.30 –	.31
No. 3, North Country, bags	lb.	.28 –	.29
Japan, cases	lb.	$0.15½ –	$0.16
Montan, crude, bags	lb.	.06 –	.06½
Paraffine, crude, match, 105-110 m.p., bbl.	lb.	.06½ –	.06¾
Crude, scale 124-126 m.p. bags	lb.	.05½ –	
Ref., 118-120 m.p. bags	lb.	.06½ –	.06¾
Ref., 123-125 m.p., bags	lb.	.06½ –	.06¾
Stearic acid, sgle. pressed, bags	lb.	.14 –	
Double pressed, bags	lb.	.14½ –	.14¾

Fertilizers

Acid phosphate, 16%, wks.	ton	$9.00 –	$9.25
Ammonium sulphate, bulk f.o.b. works	100 lb.	2.75 –	
Blood, dried, bulk	unit	3.75 –	3.85
Bone, raw, 3 and 50, ground	ton	26.00 –	28.00
Fish scrap, dom., dried, wks.	unit	5.00 –	
Nitrate of soda, bags	100 lb.	2.65 –	2.67
Tankage, high grade, f.o.b. Chicago	unit	3.10 –	3.20
Phosphate rock, f.o.b. mines			
Florida pebble, 68-72%	ton	3.00 –	3.50
Tennessee, 75%	ton	6.50 –	6.75
Potassium muriate, 80%, bags	ton	34.55 –	
Sulphate, bags, 90%	ton	45.85 –	
Double manure salt, bgs.	ton	26.35 –	
Kainit, 14%, bgs	ton	10.25 –	

Crude Rubber

Para—Upriver fine	lb.	$0.34 –	0.34½
Upriver coarse	lb.	.26 –	.26½
Plantation—First latex crepe	lb.	.35½ –	.35½
Ribbed smoked sheets	lb.	.35½ –	.35½

Gums

Copal, Congo, amber, bags	lb.	$0.08½ –	$0.10
East Indian, bold, bags	lb.	.14 –	.15
Manila, amber, bags	lb.	.14 –	.16
Damar, Batavia, cases	lb.	.28 –	.28½
Singapore, No. 1, cases	lb.	.31 –	.31½
Singapore, No. 2, cases	lb.	.21 –	.21½
Kauri, No. 1, cases	lb.	.58 –	.64
Ordinary chips, cases	lb.	.21 –	.22
Manjak, Barbados, bags	lb.	.06 –	.12

Shellac

Shellac, orange fine, bags	lb.	$0.64 –	$0.65
Orange superfine, bags	lb.	.66 –	.67
Bleached, bonedry	lb.	.71 –	.73
T. N., bags	lb.	.62 –	.63

Miscellaneous Materials

Asbestos, crude No. 1 f.o.b., Quebec	sh. ton	$325.00 –	$400.00
Shingle, f.o.b., Quebec	sh. ton	45.00 –	50.00
Cement, f.o.b., Quebec	sh. ton	15.00 –	20.00
Barytes, grd., white, f.o.b. mills, bbl.	net ton	17.00 –	17.50
Grd., off-color, f.o.b., Balt	net ton	13.00 –	14.00
Floated, f.o.b., St. Louis, bbl.	net ton	23.00 –	24.00
Crude f.o.b. mines, bulk	net ton	7.00 –	8.00
Casein, bbl., tech.	lb.	.13 –	14
China clay (kaolin) crude, No. 1, f.o.b. Ga.	net ton	6.50 –	8.00
Powd., f.o.b. Ga.	net ton	12.00 –	15.00
Crude, f.o.b. Va.	net ton	5.50 –	7.00
Ground, f.o.b. Va.	net ton	10.00 –	20.00
Imp., powd.	net ton	45.00 –	50.00
Feldspar, No. 1 f.o.b. N.C.	long ton	6.50 –	7.25
No. 2 f.o.b. N.C.	long ton	4.50 –	5.00
No. 1 gr'd. Me.	long ton	19.00 –	20.00
No. 1 Can., f.o.b., mill, powd.	long ton	25.00 –	
Graphite, Ceylon, lump, first quality, bbl.	lb.	.07 –	.07½
High grade amorphous crude	ton	15.00 –	35.00
Gum arabic, amber, sorts, bags	lb.	.13½ –	.13½
Tragacanth, sorts, bags	lb.	.50 –	.55
No. 1, bags	lb.	1.15 –	1.20
Kieselguhr, f.o.b. Cal.	ton	40.00 –	42.00
F.o.b. N.Y.	ton	50.00 –	55.00
Magnesite, calcined	ton	35.00 –	42.50
Pumice stone, imp., casks	lb.	.03 –	.40
Dom., lump, bbl.	lb.	.06 –	.08
Dom., ground, bbl.	lb.	.03 –	.05
Silica, glass sand, f.o.b. Ind.	ton	2.00 –	2.25
Sand blast, f.o.b. Ind.	ton	2.25 –	3.50
Amorphous, 200-mesh, f.o.b. Ill.	ton	20.00 –	
Glass sand, f.o.b. Ill.	ton	2.00 –	2.25
Soapstone, coarse, f.o.b., Vt., bags	ton	7.00 –	7.50
Talc, 200 mesh, f.o.b., Vt., bags, extra	ton	10.50 –	
200 mesh, f.o.b., Ga.	ton	7.50 –	10.00
325 mesh, f.o.b. New York, grade A	ton	14.75 –	

Mineral Oils

Crude, at Wells

Pennsylvania	bbl.	$3.50 –	$3.60
Corning	bbl.	1.95 –	
Cabell	bbl.	1.90 –	
Somerset	bbl.	2.05 –	
Illinois	bbl.	1.87 –	
Indiana	bbl.	1.88 –	
Kansas and Okla. under 28 deg.	bbl.	.90 –	
California, 35 deg. and up	bbl.	1.85 –	

Gasoline, Etc.

Motor gasoline steel bbls.	gal.	$0.21 –	
Naphtha, V. M. & P. deod, steel bbls.	gal.	.20½ –	
Kerosene, ref. tank wagon	gal.	.13 –	
Bulk, W.W. delivered, N.Y.	gal.	.08½ –	
Lubricating oils:			
Cylinder, Penn., filtered	gal.	.34 –	$0.35
Bloomless, 30@ 31 grav.	gal.	.25 –	
Paraffin, pale 885 vis.	gal.	.15½ –	.16
Spindle, 200, pale	gal.	.22 –	.22½
Petrolatum, amber, bbls.	lb.	.04 –	.04½
Paraffine wax (see waxes)			

Refractories

Bauxite brick, 56% Al_2O_3, f.o.b. Pittsburgh	1,000	$140–$145	
Chrome brick, f.o.b. Eastern shipping points	ton	48–50	
Chrome cement, 40-50% Cr_2O_3	ton	23–27	
40-45% Cr_2O_3, sacks, f.o.b. Eastern shipping points	ton	23.00	
Fireclay brick, 1st. quality, 9-in. shapes, f.o.b. Ky. wks.	1,000	43–46	
2nd. quality, 9-in. shapes, f.o.b. wks.	1,000	36–40	
Magnesite brick, 9-in. straight (f.o.b. wks)	ton	65–68	
9-in. arches, wedges and keys	ton	80–85	
Silica brick, 9-in. sizes, f.o.b. Chicago district	1,000	48–50	
9-in. sizes, f.o.b., Birmingham	1,000	45–47	
F.o.b. Mt. Union, Pa.	1,000	40–42	
Silicon carbide refract brick, 9-in.	1,000	1,180.00	

Ferro-Alloys

Ferrotitanium, 15-18% f.o.b. Niagara Falls	ton	$200.00 –	
Ferrochromium, per lb. of Cr, 1-2% C	lb.	.24 –	
4-6% C	lb.	.11½ –	
Ferromanganese, 78-82% Mn, Atlantic seabd. duty paid	gr. ton	115.00 –	
Spiegeleisen, 19-21% Mn.	gr. ton	32.00 –	33.00
Ferromolybdenum, 50-60% Mo, per lb. Mo.	lb.	1.80 –	2.00
Ferrosilicon, 10-12%	gr. ton	39.50 –	44.50
50%	gr. ton	72.00 –	75.00
Ferrotungsten, 70-80% per lb. of W.	lb.	.90 –	
Ferro-uranium, 35-50%, of U, per lb. of U.	lb.	4.50 –	
Ferrovanadium, 30-40%, per lb. of V.	lb.	3.25 –	4.00

Ores and Mineral Products

Bauxite, dom. crushed, dried, f.o.b. shipping points	ton	$5.50 –	$8.75
Chrome ore, Calif. concentrates, 50% min. Cr_2O_3	ton	21.00 –	22.00
C.i.f. Atlantic seaboard	ton	18.50 –	24.00
Coke, fdry., f.o.b. ovens	ton	4.75 –	5.00
Coke, furnace, f.o.b. ovens	ton	3.50 –	3.75
Fluorspar, gravel, f.o.b. mines, Illinois	ton	17.50 –	18.50
Ilmenite, 52% TiO_2 Va.	lb.	.01½ –	
Manganese ore, 50% Mn, c.i.f. Atlantic seaport	unit	.42 –	.43
Manganese ore, chemical (MnO_2)	ton	70.00 –	80.00
Molybdenite 85% MoS_2, per lb. Mo S_2, N. Y.	lb.	.60 –	.70
Monazite, per unit of ThO_2, c.i.f., Atl. seaport	lb.	.06 –	.08
Pyrites, Span., fines, c.i.f. Atl. seaport	unit	.11½ –	.12
Pyrites, Span., furnace size, c.i.f. Atl. seaport	unit	.12 –	
Pyrites, dom. fines, f.o.b. mines, Ga.	unit	.12 –	
Rutile, 94@96% TiO_2	lb.	.12 –	.15
Tungsten ore, scheelite, 60% WO_3 and over	unit	9.50 –	9.75
Tungsten, wolframite, white, 60% WO_3	unit	9.00 –	9.10
Uranium ore (carnotite) per lb. of U_3O_8	lb.	3.50 –	3.75
Uranium oxide, 96% per lb. U_3O_8	lb.	12.25 –	12.50
Vanadium pentoxide, 76%	lb.	3.00 –	3.25
Vanadium ore, per lb. V_2O_5	lb.	1.00 –	1.25
Zircon, 99%	lb.	.06 –	.07

Non-Ferrous Metals

Copper, electrolytic	lb.	$0.14¾ –	$0.15
Aluminum, 98 to 99%	lb.	.27 –	.28
Antimony, wholesale, Chinese and Japanese	lb.	.20½ –	.21½
Nickel, 99%	lb.	.31 –	.32
Monel metal	lb.	.32	
Tin, 5-ton lots, Straits	lb.	.57½	
Lead, New York, spot	lb.	.09½	
Zinc, spot, New York	lb.	.0775	
Silver (commercial)	oz.	.63¼	
Cadmium	lb.	.60– .62	
Bismuth (500 lb. lots.)	lb.	1.30–1 35	
Cobalt	lb.	2.50–3.00	
Magnesium, ingots, 99%	lb.	.90–1 00	
Platinum, refined	oz.	117.00	
Mercury, 75 lb.	lb.	79.00–80.00	
Tungsten powder	lb.	.95–1.00	

Industrial Developments of the Week

New Construction and Machinery Requirements in the Process Industries

Some Opportunities This Week

Cement	Brighton, Mass.
Chemicals	Kansas City, Mo.
Chemicals	Woburn, Mass
Dyes	New Brunswick, N. J.
Fertilizer	Jacksonville, Fla.
Glass	Massillon, O.
Hides	St. Louis, Mo.
Lime	Mankato, Minn.
Linoleum	Trenton, N. J.
Oil	Cumberland, Md.
Paint	Cleveland, O.
Refinery	Toledo, O.
Rubber	Chelsea, Mass.
Rubber	Halifax, N. S.
Soap	Cambridge, Mass.
Syrup	Fresno, Cal.

This page is of value not only as a machinery market but also as an index of the general activity and growth of the industries served by Chem. & Met. The reports are gathered by our regular correspondents who are instructed to verify every detail. Requirements for new machinery will be published here free of charge.

New England

Mass., Brighton (Boston P. O.)—Cambridge Cement Stone Co., 156 Lincoln St., in the market for complete equipment for plant addition.

Mass., Cambridge — Lever Bros., Broadway, are receiving bids for alterations to 3 story factory for the manufacture of glycerin and soap. C. T. Main, 200 Devonshire St., Boston, is engineer.

Mass., Chelsea—Panco Rubber Co., Highland St., is having sketches prepared for the construction of a one story, 50 x 60 ft. factory addition, to be used as a flux house, on Highland St. Schein & Levine, 508 Pemberton Bldg., Boston, are architects.

Mass., Woburn—Merrimac Chemical Co., 148 State St., Boston, plans the construction of additional buildings to its plant here. First unit to cost $250,000. Architect not selected.

Mass., Worcester—Samuel Lainer, 73 Green St., is receiving bids for the construction of a 1 story, 35 x 90 ft. dye house and garage, on Plymouth St. E. T. Chapin, 340 Main St., is architect.

Mass., Worcester—Worcester Polytechnic Institute, Boynton St., plans the construction of a mechanical laboratory, here. Estimated cost $350,000. Architect not selected.

Middle Atlantic

Md., Cumberland—Sinclair Refining Co., 45 Nassau St., New York City, plans the construction of a distribution and oil storage plant here. Estimated cost $100,000. Private plans.

Md., Baltimore — Union Soap Company, recently organized, has acquired a plant, at 215 Arch St., for the manufacture of soap. J. W. Kenny is president.

N. J., New Brunswick—Oxford Dye Works, Inc., plans the construction of a 1 story, dye plant, here. Estimated cost $200,000. Architect not selected.

N. J., Trenton — Certain-teed Products Corporation plans the construction of a 2 story, linoleum plant, on East State St., to replace fire loss. Estimated cost $40,000. Engineer and architect not selected. J. T. Wallace is general manager.

Pa., Philadelphia—Publicker Commercial Alcohol Co., Swanson and Delaware Aves., awarded contract for the construction of a 4 story, 70 x 70 ft., and a 5 story, 22 x 32 ft. storage and still buildings, at Delaware and Bigler Sts., to G. Kessler Construction Co., 1733 No. Marwine St.

South

Fla., Jacksonville — Armour Fertilizer Works, Talleyrand Ave., have work under way on the construction of a sulphuric acid plant of 8 chambers, connected to large furnace, at its plant here. Estimated cost $75,000.

Tenn., Chattanooga — Signal Mountain Portland Cement Co., has work under way on the third unit of its plant here. Present two units have an annual capacity of 1,000,000 bbls. and new plant will add 50 per cent to production. Cowham Engineering & Construction Co., 111 West Monroe St., Chicago, Ill. is engineer and contractor.

Middle West

O., Cleveland—Ferbert-Schondorfer Co., 12,815 Elmwood Ave., awarded contract for the construction of a 3 story, 50 x 60 ft. paint factory, on Elmwood Ave., to The Austin Co., 16,112 Euclid Ave. Estimated cost $40,000.

O., Mansfield—Mansfield Tire and Rubber Co., C. W. Stern, Pur. Agt., manufacturer of rubber tires, is in the market for new friction callenders, 2 new mills, fabric cutters, individual vulcanizers for curing balloon tires, and 350 hp. motor.

O., Massillon—Ohio Glass Products Co. is in the market for additional glass manufacturing equipment, to enlarge plant capacity.

O., Toledo—Paragon Refining Co., 2935 Front St., plans to rebuild a modern refinery, to replace fire loss, of $300,000.

West of Mississippi

Minn., Mankato—Mankato Lime Co., E. D. Coughlin, Secy., plans the construction of a lime plant here. Estimated cost $40,000. Architect not announced.

Mo., Kansas City—G. A. Breon & Co., Grand Ave., has had plans prepared for the construction of a 3 (ultimately 10) story chemical plant, on Grand Ave. near Pershing Rd. Estimated cost $200,000. Archer & Gloyd, 321 Reliance St. are architects.

Mo., St. Louis—International Shoe Co., 15th and Washington Aves., plans to install complete equipment for pickled sheepskin tannery, in its present plant at Thirteenth and Mullanphy Sts.

Tex., Waco—The Waco Drug Co., 225 South Fifth St., J. M. Penland, Pres., awarded contract for the construction of a 4 story, 100 x 165 ft. addition to its plant, to J. E. Johnson Construction Co., 203 Cameron Bldg. Estimated cost $100,000.

Far West

Calif. Fresno—Sun-Maid-Raisin Growers' Association, Holland Bldg., awarded contract for the construction of a plant, including offices and laboratory for the manufacture of syrup from raisins, to Trehwitt Shields Co., Pacific Southwest Bldg. Estimated cost $100,000.

Canada

N. S., Halifax—Leurs Cuvillier, Cunard St., West, is in the market for complete equipment for manufacture of rubber footwear and heels.

Unverified

Fla., Bartow—Oak City Guano Co. plans the construction of an addition to plant here.

Tex., El Paso—El Paso Compress and Fumigation Co., A. H. Iankes, Mgr., plans the construction of a cotton oil mill.

Tex., Pecos—El Paso Refining Co., 201 Martinez St., El Paso, W. T. Ownen, Pres., plans the construction of a cotton oil mill here, with 65 ton daily capacity. Estimated cost $50,000. Also plans to increase capacity of plant at El Paso.

Mex., Mexico City—The Huasteca Oil Co. plans the construction of a large oil refinery here.

Incorporations

Margo-Nance, Manhattan, N. Y., perfumery manufacturers, 200 shares of common stock, no par value. H. E. Herman, A. O. Ernst, H. Lelrich. (Attorneys, Herman & Ernst, 170 Broadway).

Pyorrout Laboratories, Dover, Del., manufacture remedies, $1,000,000. (United States Corporation Co.).

New York Quinine and Chemical Works, Brooklyn, N. Y., 5,000 shares, preferred, $100; 10,000 shares, no par value. F. O. McDonough, I. and D. McKesson, Rye, N. Y.

F. S. Bartlett and Son, Inc., Woburn, Mass. Waterproofing, $50,000. F. S. Bartlett, E. C. Bartlett, Winchester, G. P. Wyer, Woburn.

Newkirk Oil and Refining Co., Dover, Del. $100,000.

Jamaica Paint Co., Inc., Jamaica, New York. 200 shares, no par value. E. W. Mammen, 12 Compton Terrace, S. G. Tocher, A. W. Tocher, 48 162nd St., Jamaica.

Schrier Bros., Brooklyn, paper manufacturers, $150,000. J. and H. and I. Schrier. (Attorneys, Engel Bros., 154 Nassau St., New York).

Bean Process Syndicate, Dover, Del., manufacturing gas. $100,000. W. E. Schiels. (Registrar & Transfer Co.)

Cincinnati Portland Cement Co., Wilmington, Del. $2,030,000 (Corporation Trust Co. of America).

Economic Shoe Cleaner Products, Dover, Del. $100,000. (Corporation Trust Co. of Delaware).

Anco Finishing Corporation, Sutton Mass., textiles and chemicals, $175,000. C. H. Galpke, J. E. Howard, J. H. Meyer, D. Wood, S. R. Wrightington, Lexington, Mass.

Lac Finishing Co., Norton, Mass., paints, varnishes and lacquers, $25,000. F. N. Brooks.

Hoyt & Worthen Tanning Corporation, Haverhill, Mass., leather, hides, and wool, to conduct a tanning process. $25,000. A. Hoyt, S. L. Worthen, W. G. Cogswell.

Labor Less Chemical Co., Boston, Mass., manufacture cleaning chemicals, C. A. Bell, J. G. Weld, 33 Alverston St., Jamaica Plains, and C. H. Stone.

Gulf States Creosoting Co., Hattiesburg, Miss., increased capital from $1,250,000 to $1,500,000.

Ford Johnston Wall Paper and Paint Co., Dallas, Tex., $75,000. B. F. Johnston, 503 North Windomere St.

Ceramic Flame Co., Southampton, Suffolk County, New York, pottery, $25,000. C. H. Redfield, M. Weixelbaum, W. T. Hulse, (Attorney, G. W. Percy, Southampton,).

Alexander Co., Houston, Tex., paints, etc. $15,000. J. C. Alexander, 1504 McKinney Ave., R. E. Francis, and others.

United Fireworks Manufacturing & Display Co., St. Louis, Mo., $5,000. Manufacture and deal in fireworks. (Attorney, J. H. Connor, 602 Commercial Building, St. Louis).

Pro-Tar Products Co., Kansas City, Mo., $20,000. (Attorney, J. H. Johnson 1214-18 Grand Ave., Kansas City).

Smith & Coutts Co., Andover, Mass., paper, rubber and textile fabrics, $15,000. G. L. Smith, D. L. Coutts, Andover; M. E. Walsh, Lawrence.

United Chemical Store, Inc., Lowell, Mass., manufacture chemicals, $20,000. E. C. Street, H. M. Knapp, A. H. Johnson.